The Communicator

July—August 2024

10 GHZ!

The Bi-monthly Journal of Surrey Amateur Radio Communications

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Our article reprint policy is on page 113

Issues appear bi-monthly, on odd-numbered months, for area Amateur Radio operators and beyond, to enhance the exchange of information and to promote ham radio activity.

Contributions of articles and photos are welcome.

During non-publication months we encourage you to visit the Digital Communicator at **ve7sar.blogspot.ca**, which includes recent news, past issues of ***The Communicator***, our history, photos, videos and other information.

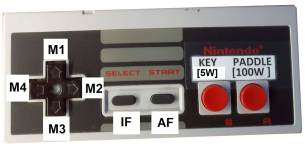
To subscribe, unsubscribe or change your address for e-mail delivery of this electronic journal, notify **communicator @ ve7sar.net**

If you find ***The Communicator*** worthwhile, regular readers who are not SARC members are invited to contribute a donation towards our Field Day fund by etransfer to payments@ve7sar.net or via PayPal.

SARC maintains a website at **www.ve7sar.net**

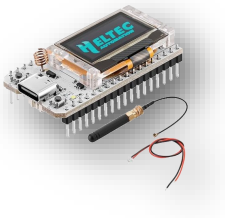
DEPARTMENTS

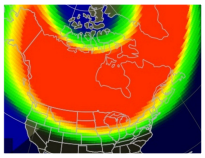
IN THIS ISSUE



Luc is back with a project for those with a late model iCOM transceiver

Curious about Meshtastic? We have a primer on what it is and what it can do.





Several articles about the amazing solar happenings of the past few months. The sun plays a huge role in our hobby. Here are some insights.

...and so much more!

QSK?

-.-- ... -.-

...from the Editor's Shack

Do you have a photo or bit of Ham news to share? An Interesting link?

Something to sell or something you are looking for?
*eMail it to **communicator at ve7sar.net** for inclusion in this publication.*

Welcome back! Its summer, Field Day and our Canada Day contest are over, time to settle in for some rays and relaxation. No! Not likely.

We have an exciting time ahead of us and an opportunity for some catch-up in the weeks ahead. We have put our popular Monday evening on-line Basic course on hold as we have an opportunity to get back into the classroom with an eager group of 24 high school students. This first ever local summer school course will provide the students with 3 course credits and the opportunity to achieve their Amateur Radio certificate. A full report in the September Communicator.

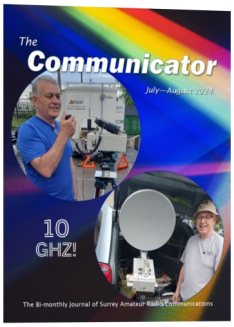
Thanks to Peter Vogel VE7AFV, we have a new method for you to enjoy our publication. A site named Calameo permits groups such as ours to post publications and have them read on screen in magazine format. You can also search and print the collection. Give it a look, its quite amazing:

https://www.calameo.com/search#search-sarc communicator/books

Finally, we have been doing quite a bit of experimentation with Meshtastic, which is an open source, off-grid, decentralized, mesh network built to run on affordable, low-power devices. You will find a complete overview in this edition. Enjoy and we appreciate your feedback.

73,

~ John VE7TI, Editor
communicator@ve7sar.net



This Month's Cover...

Another first at SARC. Dino VE7NX made a 10Ghz Field Day contact with Scott VA7SC using homemade gear. SARC is also exploring placing a 10Ghz beacon at our repeater site.

Ham and Eggs: A day's work for a chicken,
a lifetime commitment for a pig.—*Anon*

On the Web

ve7sar.net

Between Communicators, watch your e-mail for news, announcements of Amateur Radio events, monthly meetings and training opportunities.

Click the links below to follow our presence on the web and social media:

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The Rest Of The Story...

Harry Nyquist

Pioneer in sampling and data transmission

Harry Nyquist

Harry Nyquist, February 7, 1889 – April 4, 1976) was a Swedish-American physicist and electronic engineer who made important contributions to communication theory.

Nyquist was born in the village Nilsby of the parish Stora Kil, Värmland, Sweden. He was the son of Lars Jonsson Nyqvist (1847–1930) and Catarina (or Katrina) Eriksdotter (1857–1920). His parents had eight children: Elin Teresia, Astrid, Selma, Harry Theodor, Amelie, Olga Maria, Axel Martin and Herta Alfrida. He emigrated to the United States in 1907.

He entered the University of North Dakota in 1912 and received B.S. and M.S. degrees in electrical engineering in 1914 and 1915, respectively. He received a Ph.D. in physics at Yale University in 1917.

He worked at AT&T's Department of Development and Research from 1917 to 1934, and continued when it became Bell Telephone Laboratories that year, until his retirement in 1954.

As reported in The Idea Factory: Bell Labs and the Great Age of American Innovation, the Bell Labs patent lawyers wanted to know why some people were so much more productive (in terms of patents) than others. After crunching a lot of data, they found that the only thing the productive employees had in common (other than having made it through the Bell Labs hiring process) was that "Workers with the most patents often shared lunch or breakfast with a Bell Labs electrical engineer named Harry Nyquist. It wasn't the case that Nyquist gave them specific ideas. Rather, as one scientist recalled, 'he drew people out, got them thinking".

Technical contributions

Some of Nyquist's best-known work was done in the 1920s and was inspired by telegraph communication problems of the time. Because of the elegance and generality of his writings, much of it continues to be cited and used. In 1924 he published "Certain Factors Affecting Telegraph Speed," an analysis of the relationship between the speed of a telegraph system and the number of signal values used by the system.

With Herbert E. Ives, he helped to develop AT&T's first facsimile machines that were made public in 1924.

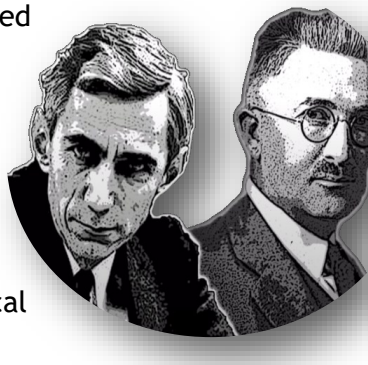
In 1932, His early theoretical work on determining the bandwidth requirements for transmitting information laid the foundations for later advances by Claude Shannon, which led to the development of information theory. In particular, Nyquist determined that the number of independent pulses that could be put through a telegraph channel per unit time is limited to twice the bandwidth of the channel, and published his results in the papers Certain factors affecting telegraph speed (1924) and Certain topics in Telegraph Transmission Theory (1928). This rule is essentially a dual of what is now known as the Nyquist–Shannon sampling theorem. This paper refined his earlier results and established the principles of sampling continuous signals to convert them to digital signals.

These two papers by Nyquist, along with one by R.V.L. Hartley, are cited in the first paragraph of Claude Shannon's classic essay "The Mathematical Theory of Communication" (1948), where their seminal role in the development of information theory is acknowledged.

As an engineer at Bell Laboratories, Nyquist did important work on thermal noise ("Johnson–Nyquist noise"), the stability of feedback amplifiers, telegraphy, facsimile, television, and other important communications problems. In 1927 Nyquist provided a mathematical explanation of the unexpectedly strong thermal noise studied by J.B. Johnson. The understanding of noise is of critical importance for communications systems. Thermal noise is named after them because of their pioneering work in this field.

In the television field, Nyquist invented a method of transmission used in broadcasting today, and also discovered a way to correct delay distortion of TV images.

In 1932 Nyquist discovered how to determine when negative feedback amplifiers are stable. He published a classic paper on stability of feedback amplifiers. His criterion, generally called the Nyquist stability theorem, can now be found in many textbooks on feedback control theory, and is of great practical importance. During World War II it helped control artillery employing electromechanical feedback systems.



Shannon and Hartley

In addition to Nyquist's theoretical work, he was a prolific inventor and is credited with 138 patents relating to telecommunications.

Nyquist received the IRE Medal of Honor in 1960 for "fundamental contributions to a quantitative understanding of thermal noise, data transmission and negative feedback." In October 1960 he was awarded the Stuart Ballantine Medal of the Franklin Institute "for his theoretical analyses and practical inventions in the field of communications systems during the past forty years including, particularly, his original work in the theories of telegraph transmission, thermal noise in electric conductors, and in the history of feedback systems." In 1969 he was awarded the National Academy of Engineering's fourth Founder's Medal "in recognition of his many fundamental contributions to engineering." In 1975 Nyquist received together with Hendrik Bode the Rufus Oldenburger Medal from the American Society of Mechanical Engineers.

The Nyquist–Shannon Theorem: Understanding Sampled Systems

The Nyquist Sampling Theorem (by Harry Nyquist, of Bell Labs, in 1928) states that as long as a certain condition is met, periodic 'samples' of a time-varying signal can be used to exactly recreate the original signal.

The Basics

Imagine you have an analog signal—something like a smooth wave representing sound, music, or any continuous phenomenon. Now, you want to digitize it, turning it into a series of ones and zeroes that computers can handle. How do you do that without losing essential information?

Enter the Nyquist–Shannon Theorem. Here's the essence of it:

If a system uniformly samples aan analog signal at a rate that exceeds the signal's highest frequency by at least a factor of two, the original analog signal can be perfectly recovered from the discrete values produced by sampling.

Let's break this down:

- Sampling: We take regular snapshots of the analog signal. These snapshots become our digital samples.
- Uniform Sampling Rate: We sample at a consistent rate. No gaps or irregularities.
- Factor of Two: Our sampling rate must be at least twice the highest frequency present in the signal.

Who Gets the Credit?

- Harry Nyquist: His work laid the foundation.
- Claude Shannon: He expanded on Nyquist's ideas and made them more accessible.
- Kotelnikov and Whittaker: Also contributed.

But let's keep it simple. We'll call it the "Fundamental Sampling Theorem." It's distinct from the Nyquist rate.

Practical Implications

Analog-to-Digital Conversion (ADC): When you record music, your microphone converts sound waves into digital samples using Nyquist's principle.

Digital-to-Analog Conversion (DAC): When you play music from your phone, the DAC reconstructs the original analog signal from those digital samples.

Telecommunications: Voice calls, video streaming, and data transmission—all rely on Nyquist's magic.

Aliasing: The Villain

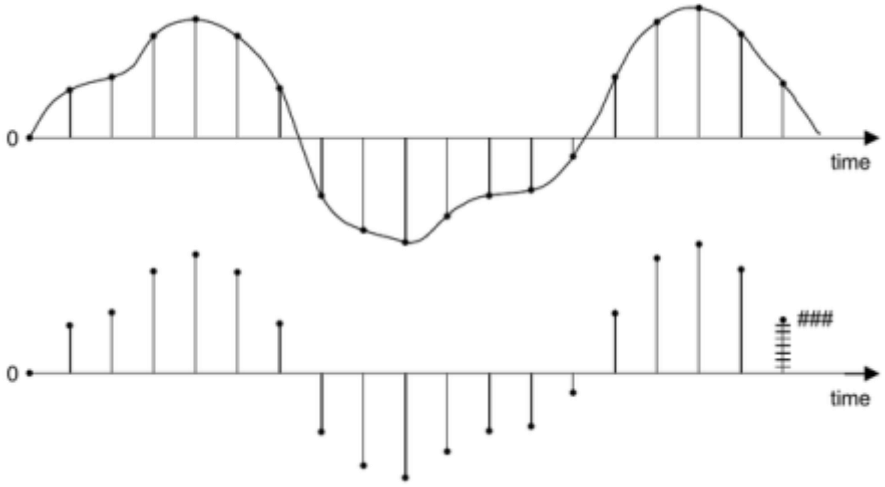
Remember, if we don't sample fast enough (below the Nyquist rate), aliasing occurs. It's like trying to watch a movie with only every other frame—it distorts the picture.

Everyone has the experience of watching TV or a movie and seeing the wheels of vehicles in motion on the screen appear to be rotating backwards. This is aliasing in action!

A classic film's frame (sampling) rate is about 24 frames per second. Therefore, the actual motion of the wheels cannot be captured - because they are more than half the sampling rate. Aliasing is the result: the tracking of the wheel motion on film is inaccurate. This shows up as discontinuity in the wheel images, and they appear to be moving backwards!

References

- There is an excellent YouTube video explaining Nyquist's work and a more math focussed one here.
- The Nyquist–Shannon Theorem: Understanding Sampled Systems
- Nyquist–Shannon sampling theorem - Wikipedia
- What is the Nyquist Theorem and Why Does it Matter? - TeleGeography
- Nyquist Sampling Theorem - GeeksforGeeks



A time-varying signal (e.g., a voltage) that is being periodically sampled (the lower diagram is the signal that results from the sampling process).

Note that the 'height' of each sample could be expressed as a numerical value (e.g., ###)

Shown above is a time-varying signal (e.g., a voltage) that is being periodically sampled (the second diagram is the signal that results from the sampling process). Note that the 'height' of each sample could be expressed as a numerical value (e.g., ### in the bottom graph).

It is a rather surprising result that the original signal can be exactly recovered from the samples when, at first glance, one might think that the original signal could have made wild movements between the samples and, therefore, we would have no knowledge of these movements from the samples (the required 'condition' of the Nyquist Sampling Theorem prevents this possibility)

The Nyquist Sampling Theorem states:

> *If a time-varying signal is periodically sampled at a rate of at least twice the frequency of the highest sinusoidal component contained within the signal, then the original time-varying signal can be exactly recovered from the periodic samples.*

Terms named for Harry Nyquist

- Nyquist rate: sampling rate twice the bandwidth of the signal's waveform being sampled; sampling at a rate that is equal to, or faster, than this rate ensures that the waveform can be reconstructed accurately.
- Nyquist frequency: half the sample rate of a system; signal frequencies below this value are unambiguously represented.
- Nyquist filter
- Nyquist plot
- Nyquist ISI criterion
- Nyquist (programming language)
- Nyquist stability criterion

Among the many honours Nyquist received were: the Mervin J. Kelly Award of the AIEE (1961), the National Academy of Engineering founders Medal (1969) and the Rufus Oldenburger Medal from the ASME (1975).

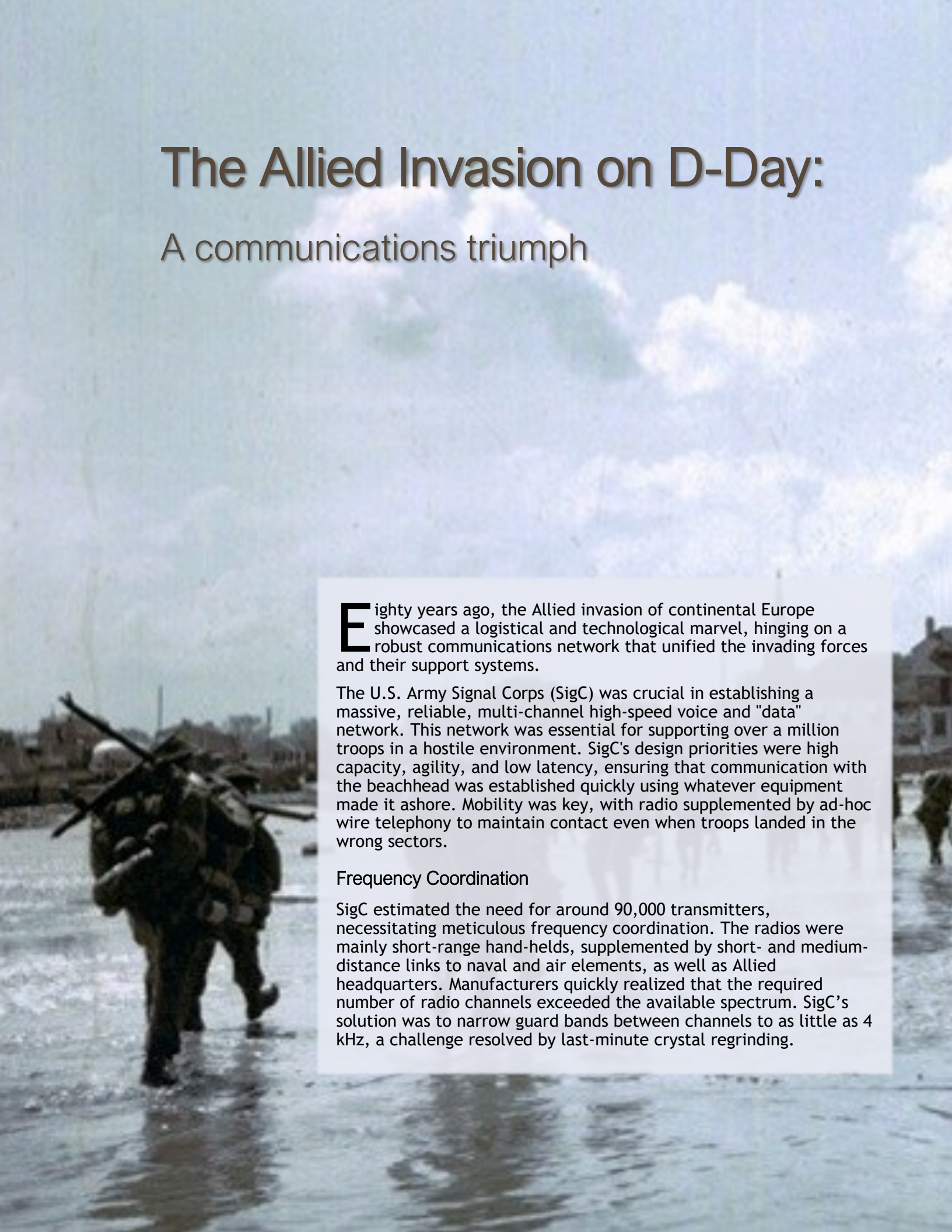
Nyquist lived in Pharr, Texas after his retirement, and died in Harlingen, Texas on April 4, 1976.

And that is history.

~

The Allied Invasion on D-Day:

A communications triumph



Eighty years ago, the Allied invasion of continental Europe showcased a logistical and technological marvel, hinging on a robust communications network that unified the invading forces and their support systems.

The U.S. Army Signal Corps (SigC) was crucial in establishing a massive, reliable, multi-channel high-speed voice and "data" network. This network was essential for supporting over a million troops in a hostile environment. SigC's design priorities were high capacity, agility, and low latency, ensuring that communication with the beachhead was established quickly using whatever equipment made it ashore. Mobility was key, with radio supplemented by ad-hoc wire telephony to maintain contact even when troops landed in the wrong sectors.

Frequency Coordination

SigC estimated the need for around 90,000 transmitters, necessitating meticulous frequency coordination. The radios were mainly short-range hand-helds, supplemented by short- and medium-distance links to naval and air elements, as well as Allied headquarters. Manufacturers quickly realized that the required number of radio channels exceeded the available spectrum. SigC’s solution was to narrow guard bands between channels to as little as 4 kHz, a challenge resolved by last-minute crystal regrinding.

Despite losing some radio gear during the initial landings, SigC's planning for battle attrition ensured successful contact with the beach, although some high-power voice-channel transmitters were delayed. Remarkably, electronic communications were so effective that 500 pigeons, intended for emergency messaging, were rendered unnecessary.

Network Communications

Beyond tactical communications, reliable high-capacity links with headquarters in Britain were essential. Initial contact was established through shore-based transmitters reaching offshore relay ships, which retransmitted signals to England. SigC teams soon established multi-channel carrier systems directly from France to England. By the end of June, cable ships had laid wire communications across the channel, overcoming initial setbacks.

Media Communications

The need to keep the world informed was recognized, with efforts led by David Sarnoff of RCA, appointed by General Dwight Eisenhower. Sarnoff coordinated media communications, establishing a media route through the London Signal Center and securing additional shortwave paths to America.

In the months leading up to the invasion, American journalists faced opposition from the British, who were unaccustomed to their demands for information. SigC established FAX, a full-duplex

(Continued on page 10)

Here are some factoids about D-Day

- D-Day occurred on June 6, 1944.
- Operation Name: The invasion was codenamed Operation Overlord.
- Beaches: The main landing beaches were Utah, Omaha, Gold, Juno, and Sword.
- Forces Involved: Approximately 156,000 Allied troops participated.
- Nations: Troops from the United States, United Kingdom, Canada, and other Allied nations took part.
- Casualties: Estimated Allied casualties on D-Day were around 10,000, with 4,414 confirmed dead.
- Logistics: Over 5,000 ships and landing craft were involved in the invasion.
- Air Support: Around 13,000 aircraft supported the invasion.
- Objectives: The goal was to establish a foothold in Nazi-occupied France and begin the liberation of Western Europe.
- Leadership: The operation was commanded by General Dwight D. Eisenhower.
- Resistance: German forces, led by Field Marshal Erwin Rommel, heavily fortified the Normandy coast.
- Outcome: D-Day was a decisive victory for the Allies, leading to the eventual defeat of Nazi Germany.

shortwave channel direct to the U.S., which became the official channel for communiques from the Supreme Headquarters Allied Expeditionary Force (SHAEF). This channel also cued radio networks in a party-line arrangement.

Media Coverage

Journalists had to adhere to certain ground rules. With limited seats for the initial invasion, radio reporting was pooled and coordinated by Edward R. Murrow. Print copy was shared among competitors, and American networks were allowed to record radio news reporting for the first time.

On the morning of June 6, German Radio announced the invasion, prompting network newsrooms to await confirmation. The first official communique arrived around 2:30 a.m. From then on, teletype and pool reports kept the world informed.

Challenges and Innovations

Journalists aboard ships or aircraft wrote copy and made recordings en route, disembarking in England for review and censorship clearance. From the battlefield, reporters used transcription machines, with recordings shipped to London via naval transport or the SHAEF Shuttle. Once cleared, recordings and live reports were forwarded to shortwave transmitters.

Two commercial companies, Press Wireless and Mackay Radio, established a connection from the continent to the U.S. Press Wireless became operational early under pressure, allowing for the transmission of extensive written media reports.

The communication efforts during the Allied invasion were a triumph of planning and innovation. While the valor and sacrifice of the soldiers were paramount, the success of the invasion was also due to the remarkable efforts of the SigC and their ability to overcome numerous challenges in ensuring effective communication. The coverage of D-Day by journalists became known as "The Biggest Beat," highlighting the critical role of media in documenting this historic event.

~

Celebrating 80 Years of D-Day with Amateur Radio Operators Worldwide

June 6, 2024, marked a significant milestone in world history as amateur radio operators from around the globe came together to commemorate the 80th anniversary of the D-Day landings. This momentous occasion saw a surge in amateur radio activity, with operators from over 30 countries participating in a unique event to pay tribute to the brave men and women who fought for our freedom.

A Global Tribute

To mark this historic occasion, amateur radio enthusiasts from Canada, the United States, the United Kingdom, France, and many other nations took to the airwaves, using their skills to connect with fellow operators and share stories of the D-Day landings. The event, organized by the Normandy American Cemetery and Memorial, brought together operators from diverse backgrounds, united in their passion for amateur radio and their respect for the heroes of D-Day.

Special Event Stations and Call Signs

To commemorate the 80th anniversary, special event stations were set up in various locations, including the American Cemetery in Normandy, the USS Midway Museum in San Diego, and the Canadian War Museum in Ottawa. These stations, identified by special call signs, allowed operators to make contact with other participants and exchange information about the D-Day landings. In Canada, the Radio Amateurs of Canada (RAC) issued a special call sign, CG80DDAY, to mark the occasion.

One of the most significant D-Day 80th anniversary amateur radio events is the "D-Day 80 Special Event," organized by the European DX Foundation (EUDXF) and the National Association for Amateur Radio (NAAR). This event will take place from June 1 to June 30, 2024, and will involve more than 100 amateur radio stations from around the world. These stations will use special call signs, such as "DD80" or "D-DAY80," to identify themselves and to commemorate the anniversary.

Digital Modes and QSOs

In addition to traditional voice communications, many operators used digital modes such as FT8, JS8Call, and Olivia to connect with other stations. These modes allowed for fast and reliable communication, enabling operators to exchange information and stories about the D-Day landings. Throughout the day, operators reported making numerous QSOs (contacts) with stations from around the world, sharing their experiences and paying tribute to the heroes of D-Day.

New Technologies and Innovations

The 80th anniversary event also saw the introduction of new technologies and innovations in amateur radio. Many operators used software-defined radios (SDRs) and digital signal processing (DSP) techniques to enhance their signals and improve communication. Additionally, some stations employed satellite communications and amateur television (ATV) to share images and videos of the event.

Preserving History and Honouring Heroes

The D-Day 80th anniversary amateur radio event served as a poignant reminder of the importance of preserving history and honouring those who have served. By using their unique skills to connect with others, amateur radio operators helped to keep the memory of D-Day alive, ensuring that future generations will never forget the sacrifices made during World War II.

The June 6 D-Day 80th anniversary amateur radio event was a resounding success, bringing together operators from around the world to commemorate a pivotal moment in history. Through their efforts, these dedicated individuals helped to preserve the legacy of D-Day, fostering a sense of community and camaraderie that transcended borders and time zones. As we look to the future, it is heartening to know that the spirit of amateur radio will continue to play a vital role in preserving our collective heritage.

~

News You Can't Lose

May 2024—A month to remember

By: JOHN SCHOUTEN VE7TI

On May 24, 2024, the cosmos put on a show that left astronomers, sky-gazers, my family and I in awe.

The solar storms of May 2024 were a series of powerful solar storms with extreme solar flares and geomagnetic storm components that occurred from May 10-13th. A barrage of large solar flares and coronal mass ejections (CMEs) launched clouds of charged particles and magnetic fields toward Earth. This created the strongest solar storm to reach Earth in two decades, and possibly one of the most intense displays of auroras on record in the past 500 years.

The Colossal X-Class Solar Flare

After a revolution of the sun, the colossal sunspot group AR3664, responsible for these epic solar storms and widespread auroras, revealed its return in explosive fashion. A powerful X-class solar flare erupted from the sun's southeastern limb. Solar flares are energetic eruptions of electromagnetic radiation from the sun's surface that occur when magnetic energy accumulating in the solar atmosphere is released. This X-flare clocked in at an X-2.9 according to Spaceweatherlive.com..

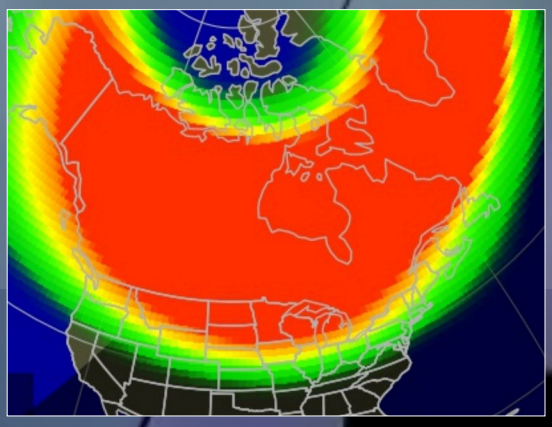
The hyperactive sunspot group AR3664, the most active of the sun's current solar cycle, was the most likely culprit for the recent X-flare. Scientists can track the sunspot's progress across the sun's far side by observing how it affects the sun's vibrations or seismic echoes, using helioseismology data.

The Impact on Earth

The solar storms and the subsequent X-class solar flare had a significant impact on Earth. They resulted in one of the strongest displays of auroras in the past 500 years. These auroras, also known as the Northern and Southern Lights, painted the sky with a dazzling array of colors, providing a spectacular sight for those lucky enough to witness it.

The solar events of May 2024, were a testament to the immense power and beauty of our sun. It served as a reminder of the dynamic and ever-changing nature of our solar system. As we continue to study these events, we gain a deeper understanding of the sun's behavior, which can have significant implications for our technology-dependent society.

This issue has an informative pair of articles by Mark Mattila VA7MM, starting on page 55.



Page 13—News You Can Lose

The Lighter Side of Amateur Radio

Local club accidentally invites people to Field Day

by K5KVN, on the scene

MADISON, TEXAS – A southern Texas amateur radio club is scrambling to figure out how to keep people away from their Field Day activities after a newspaper published details about their event.

“We just wanted the bonus points, not visitors,” said Nathan Binn.

“I sent an email to our small-town weekly newspaper expecting them to ignore it like they do every year. Instead, they published the date and time of our event, our hotel room number, my cell phone and my email address,” he said.

Binn became concerned after receiving a phone call from the proprietor of the Best Western Inn. The hotel manager, Louis Downington, told Ham Hijinks, “When the room was booked I was under the impression that it was just five guys fooling around with ham radio. But then I read in the newspaper it was an ‘event’ at my hotel and wasn’t happy at all.”

“This year, we decided to set up at the hotel with our gear and portable antennas to enjoy indoor amenities like air conditioning and a vending machine while operating,” said Binn.

But our radio club actually doesn’t want visitors. “We’re not very sociable people,” said Binn. “And our food plans do not include enough rations for more than our group.”

“We are grateful for the bonus points, but I don’t know what we’ll do if someone shows up,” he said.

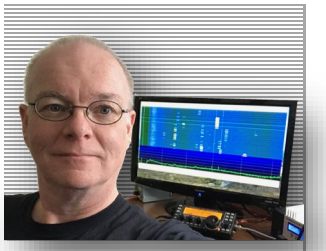
~ Ham Hijinks

Radio Ramblings

The Easy CW Decoder Part II

How the software will decode CW characters

by KEVIN McQUIGGIN VE7ZD / KN7Q



Kevin VE7ZD/KN7Q is active in EME, meteor scatter and much more. He lives on Vancouver Island

Welcome to the summer! I hope that we have nice weather, avoid inhospitable "heat domes", and that "smoke season" is much reduced from that it's been over the last few summer seasons. Heat and smoke can adversely affect both our amateur radio stations' hardware and our enjoyment of operating.

This issue I would like to continue our discussion of the easy CW decoder from last issue [1] and look specifically at how the software will decode dots and dashes to decode CW characters. I'll present a good portion of the Arduino "Sketch" program and put the entire program up on GitHub for you to download and run yourself. See below for the URL.

Next issue I'll close the loop on the project by presenting the hardware interface that will connect your radio to the Arduino and allow you to decode CW "live" from the air. I'll be posting the schematic and PCB (printed circuit board) layout on GitHub. Those interested will be able to order a PCB from OSHPARK [2] and "stuff the board" themselves to have a working decoder.

For those in SARC who participated in last spring's CW decoder kit build project, I'm also looking at whether my software can be loaded into the existing kits to potentially improve their decoding performance. I'll advise on that possibility next issue.

Recap

Morse code contains three foundational elements:

- The ***dit***;
- The ***dah***; and
- The ***quiet period*** (or space) between CW symbols.

Any decoder needs to be able to distinguish between dits and dahs and must be able to tell when a symbol (letter, number, punctuation, prosign, et cetera) is complete.

We can express the relative duration of these code elements as a ratio: 1:3:3.

A ***dit*** is the base element and is given a time value of **one**; a ***dah*** is **three** times longer than a dit; and the quiet period after a full symbol has been sent is also **three** times longer than a dit. The quiet period is used to indicate that the current CW symbol is complete.

This 1:3:3 ratio applies ***no matter what the speed of the Morse code being transmitted or received is***. Whether CW is being received at 5 words per minute (WPM) or 30 WPM, this ratio remains constant.

We need to be able to distinguish dots from dashes – and detect the end of a CW symbol. A creative way to decode CW is to calculate the *average length of time* that the dots and dashes in a recent set of characters takes. Each code element (a dot or a dash) is then compared to this average: if the current code element is shorter than the average it is recorded as a dot; if longer than the average then it is recorded as a dash.

Dots and dashes, as calculated by this algorithm [8] accumulate until a period of silence (the space between CW characters) is recorded. Then the accumulated symbol (set of dots and dashes) can be looked up in a table to determine which alphabetic symbol it represents.

This algorithm differs from other popular CW decoding methods in that it doesn't compare dots and dashes to specific time values - it just compares them to the average length of ALL recent code elements. This is called "fuzzy" decoding.

I chose 16 code elements for the average through experimentation because it seemed to represent a fair balance between the speed that the algorithm adapts to a new code speed and the length of time that an operator is probably willing to wait to see "good" decodes on her screen [9] [10].

The method works quite well and has the advantage that the averaging process automatically adapts to changing code speed. If you are decoding a 5 WPM signal, and then tune down the band to receive some "hot" CW operators at 35 WPM, the algorithm will automatically adjust as the shorter duration of the faster code elements comes to dominate the average time value. The program will usually adapt to a new CW speed in a few characters.

How To Accomplish This?

Most readers are probably not computer programmers so I will present the code in snippets that each provide necessary functionality. Don't worry if you are not a programmer (or, a "coder", in recent parlance)! I'll guide you through what the code snippets do.

The complete program, written as a "Sketch" for Arduino systems, is available

on GitHub [3] at https://github.com/mcquiggi/CW-Decoder. I publish it under the GNU Public License (GPL) as open-source software. This means that you can use the code and modify it as you wish, but that your source code must also remain available to others who also may wish to use or further modify it [13].

A) Hardware Interface:

For this part of the article, we will use a single pin on the Arduino for CW input. We will use pin 2:

```
const int CW_PIN = 2;      // CW input is on Digital Pin 2
```

We also need to tell the Arduino that pin 2 will be an input:

```
pinMode(CW_PIN, INPUT);
```

Grounding the pin will produce a signal (think of the tone that comes from a code practise oscillator when the key is pressed), and "ungrounding" the pin (releasing the key) will produce no signal.

You will be able to test the code from this issue by connecting a CW key to pin 2 and tapping out your message. See Figure 1 below for a simple interface. Tap out some CW and watch your computer's screen for the decodes.

The next stage will be to connect your radio to the decoder. Next issue I will provide a schematic and printed circuit board (PCB) for an interface that will allow you to connect the audio signal from your radio to pin 2. You will then be able to decode CW "off air".

For this article, though, imagine a CW key connected to pin 2 of your Arduino that is providing input to the decoder.

B) Representation of CW Symbols

Each CW symbol will be stored in a lookup table (a *matrix* [11]) using a 0 for a dot and a 1 for a dash. Letters A through Z, numbers 0 through 9, and common special symbols like the period, comma, and question mark will be stored in the table too. There are 42 symbols in the table.

Examples: 'C' sounds like "dahdidahdit" and will be recorded in the table as '1010'. The letter 'Z' sounds like "dahdahdidit" and will be stored in the table as '1100'. 'E' will be stored as '0' in the matrix; '9' as '11110'. You get it!

We don't have space to include the entire lookup table here, so here is an excerpt. First, we define the table:

```
char pattern[42][8];
```

The table, called 'pattern', will have 42 rows (to hold a maximum of 42 symbols), and each symbol will have a maximum of 8 code elements (dots and dashes) in it. Then we initialize the lookup table. Here are a few sample entries:

```
strcpy(pattern[ 0], "01");     // A
strcpy(pattern[ 1], "1000");   // B
strcpy(pattern[ 2], "1010");   // C
...
strcpy(pattern[23], "1001");   // X
strcpy(pattern[24], "1011");   // Y
strcpy(pattern[25], "1100");   // Z
strcpy(pattern[26], "01111");  // 1
strcpy(pattern[27], "00111");  // 2
strcpy(pattern[28], "00011");  // 3
...
strcpy(pattern[36], "001100"); // ?
strcpy(pattern[37], "110011"); // ,
strcpy(pattern[38], "10001");  // -
```

Note how the pattern of 0s and 1s for each CW symbol matches the dots and dashes for that letter or number in CW. 'A' is "didah" (or dot-dash), and this is represented in the lookup table by '01'.

C) Timing the Duration of "Key Down" Events

We will need to time the duration of code elements when the key on pin 2 is depressed. We will have to determine whether each code element is a dot or a dash.

This algorithm is clever: it does not time each key down event precisely, like other (*more poorly performing*) algorithms do [6]. Rather, it measures time in terms of "chunks" of 10 milliseconds. This seems odd: wouldn't it be better to record key down times exactly?

The answer is no: by purposefully measuring key down events at a coarse resolution of 10 milliseconds, the software can compensate for every human CW operator's natural variability [4].

We humans are not all that precise: even a highly skilled CW operator will display some variability in his or her "fist" and generate dits and dahs that are of slightly different durations, even within the same character. Exact measurement leads to unnecessary code complexity and decoding error.

By measuring code element duration exactly, poor algorithms keep *very* busy trying to track a human operator's natural variation and this affects the overall performance of the decoding software.

This algorithm for this project has built-in fuzziness or "slippage" regarding CW timing, improving its overall detection accuracy. Sometimes simpler is better!

How do we measure code element duration? Whenever pin 2 gets grounded (think of a CW key going up and down) we need to time the event. When the key goes down, we measure the duration as follows:

```
// Time the key-down event:
int key_down_time=0;
while (digitalRead(CW_PIN)) {
  key_down_time++;
  delay(10);
}
```

We set a counter called key_down_time to 0, and increment it by one for every 10 milliseconds that the key is held down. Once the key is released, key_down_time will hold a positive integer that records how many 10-millisecond periods that the key was held down for.

Was this last code element a dot or a dash? To decide, the value in key_down_time is compared to the average duration of the last 16 code elements.

How do we know what the average duration of the recent dots and dashes is? Let's look at this next.

D) Computing Average Key Down Times

Once we have a newly generated key_down_time, we need to compare it to the average key down time of the last 16 code elements. We will have to calculate this average and keep it up to date, because the speed of received CW will change as the user tunes between signals on the amateur bands. We want the algorithm to automatically adapt to changes in speed of received CW.

Let's see how we store the last 16 durations, and how we calculate the average duration of these code elements.

We define an array 'time' of 16 integers. Each element will hold an integer that denotes the duration (in 10 millisecond chunks) of that code element. Only the last 16 code element durations will be stored. A new duration replaces the oldest duration in the list, so that the array always reflects the 16 most recent durations. We also define counters that will store the average element duration, the last key-up duration, and the last key-down duration:

```
int time[16];
```

Now for a slightly complicated segment of Sketch code. We define a function called update speed() that:

Records the latest element duration in the time[] array; and then

Recomputes the average duration for the last 16 code elements.

The update speed() function simply stores the latest duration in time[] and recomputes the average. The dot/dash decision is performed in another section of the Sketch code that will be described below.

The average duration value is critical to the entire algorithm. Recall that the duration of each new code element will be compared to the average to determine whether it is a dot or a dash. Fuzzy decision making is used: a received element *shorter* than the average will be recognized as a dot; *longer* than average, a dash.

Here is the Sketch code for update_speed():

```
int update_speed() {
  static int p=0;
  int j, n, sum;
  // Record last key down time:
  time[p]=key_down_time;
  p=(p+1)%16;
  // Recompute average time for a code element:
  sum=0;
  n=0;
  for (j=0; j < 16; j++) {
    if (time[j] != 0) {
      sum+=time[j];
      n++;
    }
  }
  return round(sum/n);
}
```

This function returns the sum of the past 16 most recent code element lengths divided by 16, rounded to the nearest integer [5]. This is, of course, the average of the latest 16 code element durations.

E) Building a CW Character

We've come a long way in the decoding process. There are only a couple of stages left before we can decode the character by looking it up in the translation table pattern []. Let's fill in the gaps.

At this point we have a new code element. We need to decide whether it is a dot or a dash. A simple comparison to the average calculated by update_speed() will let us classify the new code element as a dot or a dash. Then we need to append this dot or dash to the CW character being received.

An character array called symbol[] stores the dots and dashes of a CW symbol as it is being received. Each symbol can have a maximum of 8 code elements in it:

```
char symbol[8];
```

symbol[] gets set to an empty string at the start of every CW symbol. It grows by one character as each dot ('0') or dash ('1') is received.

For example, imagine that reception of a CW symbol is in progress. Imagine that we have already received the sequence '01' (dot-dash). The newest code element needs to be added to that sequence:

If the newest symbol is a dot, then we need to add a dot to the received sequence: the sequence will become '010' ('01' plus a dot); or

If the newest element is a dash, then we need to append a '1' to the received sequence to make it '011'.

Adding a '0' (a dot) or a '1' (a dash) to the end of symbol[] is done like this:

```
  // Interpret code element:
  if (key_down_time <= avg_speed)
```

```
    strcat(symbol, "0");
  else
    strcat(symbol, "1");
```

The Sketch (C language) function strcat() appends one string to another. key_down_time is checked to see whether it is greater than the average code element duration. If it is, we append a '1' (a dash) to symbol[]; otherwise we append '0' (a dot).

In this manner each newly received code element is appended to the current symbol []. We build CW symbols one dot or dash at a time. Once we reach the end of the CW symbol, we will then need to decode it. We will look up symbol[] in the pattern[] table to find a match.

This begs the question *"how do we know that we have received the last code element of a symbol?"*

F) Detecting the End of a CW Symbol

This is a critical question. To answer it let's move back to the "organic" realm: when we *listen* to CW, how do we identify the end of each CW symbol?

The answer is that we use *the period of silence after the last code element* to tell us that we have reached the end of the current symbol. This tells us that it is time to "decode" the symbol – we use our brain to write down "Q" after we have heard "dahdahdidah".

The CW specification (the 1:3:3 timing ratio that we discussed in part I of this series [7]) tells us that *a period of silence equal to the duration of a dash denotes the end of each symbol*. We need to quantify this silence so we can use it to detect inter-symbol spaces.

As described in much detail above, in our program we measure "key down" times in chunks of 10 milliseconds whenever the key is depressed. We can use exactly the same approach to measure the duration of "key up" events. Key-up means *silence*. We can measure the duration of a "silence event" as well.

Whenever the key is up (in hardware: when pin 2 of the Arduino is ungrounded), we can count the number of 10-millisecond chunks to measure the period of silence much as we count key down periods. This is how we determine the end of each CW symbol.

The central routine (called the "processing loop") of our Sketch includes measurement of silent periods (those periods when they key is up). Each period of silence is then compared to the average code element duration (the same average that we use to differentiate between dots and dashes).

If a period of silence is greater than the average value, then we know that we have reached the end of the current CW symbol: it is time to look it up and translate it to a letter, number, or prosign.

G) Looking Up the Result

The Sketch includes a function called lookup_symbol() that looks up a CW symbol (stored in symbol[]) and returns that symbol as a letter, number, or CW prosign. If "1010" (dahdidahdit) is the current symbol, then "C" will be returned.

If the received CW symbol *doesn't* match a known symbol (letters A-Z, numbers 0-9, or prosign - one of "?,-(./") then lookup_symbol() indicates an error by returning 0:

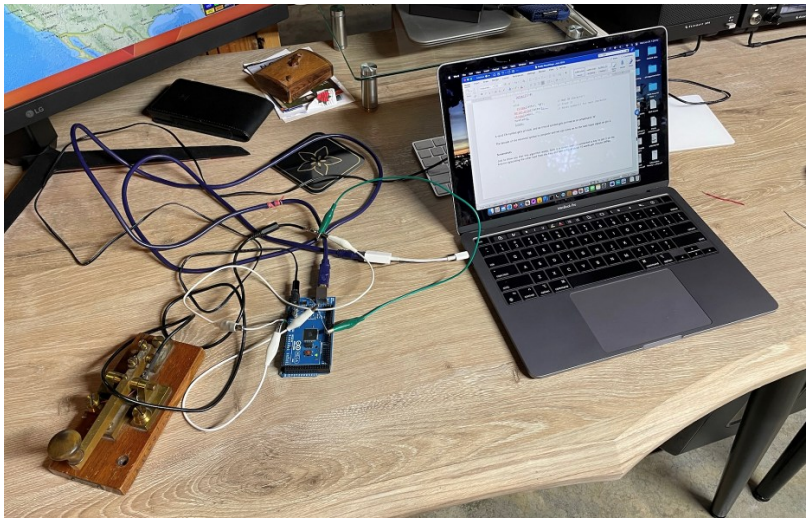
```
// Function to look up a dot-dash pattern
and return the alphanumeric character
// it represents:
char lookup_symbol() {
  int j;

  for (j=0; j < strlen(alphabet); j++) {
    if (strcmp(pattern[j], symbol) == 0)
```

```
      return(alphabet[j]);
    }
    return 0;                    // Return 0 if
the symbol was invalid
        }
```

H) Tying It All Together

We've made it to the end of the decoding algorithm. Here's where the Sketch uses lookup_symbol() and sets another character string letter[] to the character that was received:

```
      c=lookup_symbol();          // Look up
the symbol
      if (c != 0) {
        letter[0]=c;
        letter[1]=0;
      }
      else
        strcpy(letter, "@");      // Bad CW
character!
      Serial.print(letter);       // Print it
      strcpy(symbol, "");         // Reset
symbol[] for next character
      handled=1;
      break;
```



A valid CW symbol gets printed, and an invalid symbol gets printed as an ampersand '@'.

The decode of the received symbol is complete and we can move on to the next input signal on pin 2.

Straight Key Interface to Pin 2

Testing the program using a straight key connected to the Arduino's digital pin 2 requires a simple interface circuit. See Figure 1. A 10K "pulldown" resistor sets the input pin to a default value of '0'. The key is used to place 5 volts onto the pin, which will then read as a '1' when the pin is interrogated by our software. The pin's digital values will vary as 0,1,0,1… as the key is operated when CW is being sent.

Screenshots

Just to show you that this algorithm works, here are some screen grabs. I connected a key to pin 2 (see Figure 1) and sent a short CQ at about 5 words per minute (WPM).

My setup is shown in Figure 2. Figure 3 shows the output from the Sketch.

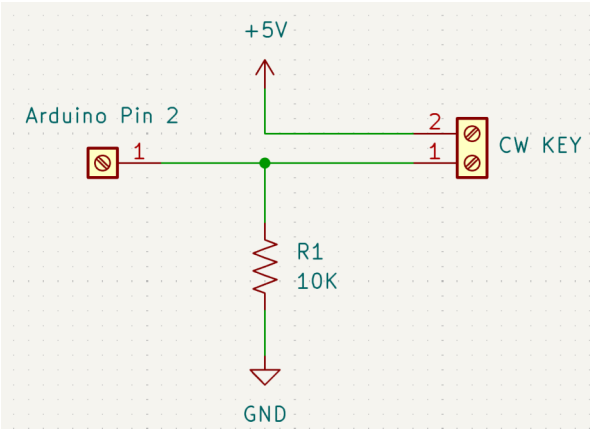


Figure 1 [above] – Test Interface with CW Key

Figure 2 [left] – Test Bench with 1920s Straight Key Attached to Pin 2

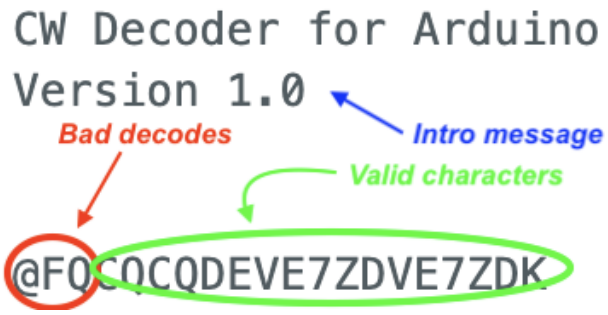


Figure 3 – Output Displaying a Short CQ

Note the valid decode: "CQ CQ DE VE7ZD VE7ZD K".

There's some valuable information in this Figure:

- Note the introductory message that identifies the decoder and its version number. I did not show this code segment in the discussion above, but it's a good idea to add an introductory message to every program
- Note the "garbage" characters **@F** at the start of the message. These are from program start up, before the algorithm has been able to calculate a valid average code element speed!
- Note that after the second character, the CQ message is decoded correctly. This is because enough code elements have been collected to steer the average calculated by the update_speed() function to a valid value
- Note the lack of spaces (blanks) between letters in the CQ message. All the received characters are pushed together. This is only because I have not added this functionality yet! I did not want to over-complexify the explanation of the algorithm. We will add this functionality to the version of the program for the next installment! There's a summary of what needs to be done in [12].

Just to show the adaptability of the algorithm, I followed the above example (at 5 WPM) with a change to 15 WPM. A screenshot of the output:

Figure 4 – 15 WPM Message Decoded

The algorithm took only about three characters to adapt to the increase in my CW speed. There are still no spaces between the words, but we will fix that soon [12].

Next Issue

Next installment I will present an interface between this code and your radio. This will include a philosophical discussion of what needs to be done in the interface, a schematic, and a PCB that you can order from OSHPARK and assemble yourself.

To summarize, the interface needs to accept input from the audio channel of your receiver, process the off-air audio, and detect a CW signal. It then needs to convert the detected audio to a digital signal with 0 representing silence and 1 representing a code element.

The beauty of this approach is that that the resulting digital signal can then simply be connected to pin 2 of our Sketch program. We won't need to change our program at all.

As we shall see, the audio processing is critical to the decoder's off-air decoding performance. Poor audio processing can give very poor results. Other decoders I have seen don't include any signal processing before they try to detect the CW signal. This is a recipe for poor performance.

I have added a small audio conditioning stage before the CW detection hardware, and that seems to work better than what I have seen in other units. My approach is not perfect as I am not an engineer or signal

processing professional, but it has performed fairly well for me - better than some other decoders. You're welcome to try it.

The schematic and PCB will be available for download, also on GitHub.

Conclusion

That's it for this issue. I hope that my description of how the CW decoding algorithm works and how it is implemented in the Sketch programming language was understandable. Perhaps it will inspire you to learn more about programming, or to explore the amazing capabilities of Arduino processors and similar microcontrollers. The sky is the limit. Programming is an incremental skill, and you can learn how to code at any age and without any formal experience. You start by solving simple problems and as you learn you will be able to take on progressively more complex challenges. Almost before you know it, you will be writing your own software-defined radios!

Enjoy the summer. Remember that feedback on Radio Ramblings is always welcome and can be directed to the Editor, or directly to me at mcquiggi@sfu.ca. Thanks for reading!

73,

~Kevin VE7ZD / KN7Q

References

[1] See the May/June 2024 Communicator for Part I of this article.

[2] OSHPark is a leading fabricator of custom printed circuit boards (PCBs) for hobbyists and industry. The company is located in Oregon, USA so there is no issue with theft of your intellectual property, a common problem with many offshore PCB fabrication companies. You can use KiCAD or Eagle to design your own circuits and PCBs and submit your PCB design to OSHPark. They will fabricate your board and ship it to you at very low cost (generally about $1 per square inch of PCB). I have been a customer of OSHPark for almost a decade. See https://oshpark.com.

[3] GitHub is a globally accessible software repository that is used to store and share code, and that facilitates collaboration between developers, allowing them to work together to develop all sorts of applications. Participation costs nothing. GitHub can be used for private coding projects, but its primary focus is on open-source application development. See https://github.com and https://en.wikipedia.org/wiki/GitHub.

[4] Using 10 milliseconds as a measuring stick also sidesteps a physical characteristic of mechanical switches called "bouncing". When any mechanical switch gets thrown, the contacts never "make" or "break" cleanly. The switch contacts bounce around (opened-closed-opened-closed-...) for a very short period of time before they "settle" on the new switch position. See "Contact Bounce" under the article at https://en.wikipedia.org/wiki/Switch.

[5] Computer-savvy readers might note that when there are less than 16 code element durations recorded, the average is based only on these non-zero durations. This is to ensure that the decoder "comes up" and delivers reasonable results for the user quickly after the program is started. After 16 code element durations have been calculated, the average always uses 16 as the divisor in average calculation. See [10] for potential improvements in efficiency, though.

[6] I have reviewed the source code for many CW decoders over the years and have noted that very few of them use this "fuzzy" approach to timing. Most programs try to measure dot and dash duration to an accuracy of milli- or even microseconds. Human CW sending can never be this consistent!

[7] Recall from Part I that the ratio 1:3:3:5 specifies the relative duration of a dot; a dash; an inter-symbol space; and the space between words. If duration of a dot is denoted as 1, then a dash is three times longer. The space between characters is also duration 3, and the end of a word is of duration 5, all relative to the duration of a dot. In our algorithm we do not interpret these ratios precisely, but we use the average code element length to determine dots, dashes, inter-symbol spaces and inter-word spaces in a "fuzzy" manner that automatically adapts to changing CW speeds.

[8] "Algorithm" is a technical term for a "method" or "process". From Wikipedia: "… an algorithm is a finite sequence of … instructions, typically used to solve a class of specific problems or to perform a computation." The term has its roots in a mathematical text written in approximately 825 CE by Persian scientist Muhammed al-Khwarizmi. The anglicized version of his surname "al-Khwarizmi" became "algorithm". See https://en.wikipedia.org/wiki/Algorithm.

[9] I write about digital signal processing (DSP) quite often in this column. It is amazing how different topics and ideas often overlap. In a DSP context the averaging of the dot and dash code element duration is just a form of "finite impulse response" (or FIR) filter. Averaging the duration of 16 code elements is represented in the DSP context by a 16-tap transversal FIR filter.

[10] There's a great discussion of FIR filters in the very popular introductory book, "Understanding Digital Signal Processing", 2001, by Richard G. Lyons. See chapter 5.

[10] For computer-savvy readers: I also chose to average 16 elements because dividing the sum of the elements by 16 (to calculate their average) can be accomplished by simply shifting the bits holding the sum to the right by 4 bits. Each bit shift divides the value by 2. 2^4 is 16, so we need shift right four times. Bit shifting is a much faster operation than performing a division operation.

[11] I'll use technical terms from computing science to introduce you to these terms. A matrix is a 2-dimensional table (or array) of numbers or other data. A vector is a 1-dimensionsal array. In human terms, and in our context, a vector is a list of numbers, and a matrix is a table of numbers.

[12] The way we will add automatic insertion of spaces after words is to check for a period of silence that is 1.5 times the average. If the silent period exceeds this value, then our program will output a space.

[13] Thousands of applications have been released as open-source software. Linux and Android are good examples of source code released under the GPL. Open-source supports innovation and improves software quality.

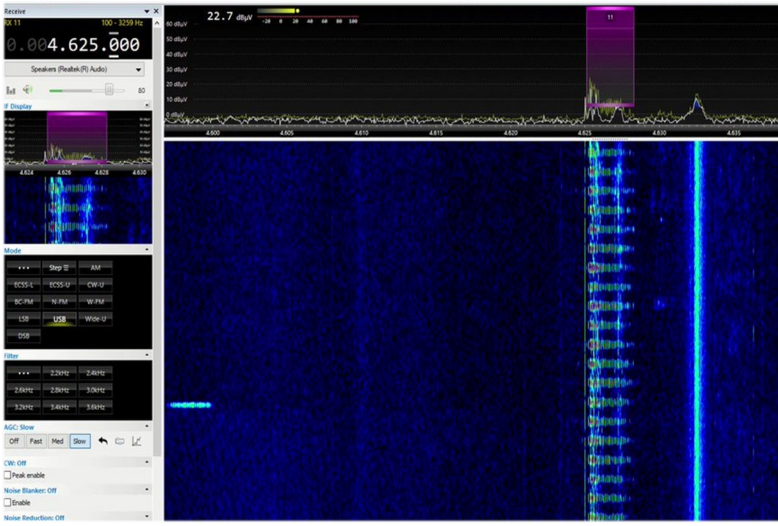
January 2024 presentation by Kevin McQuiggin VE7ZD/KN7Q

on GNUradio - building radio circuits on your computer. Kevin's presentation is now available on video at:
https://youtu.be/OyJmGUyrbho

A Cold War Relic with Modern Mysteries

The Enigmatic Buzzer

by JOHN SCHOUTEN VE7TI



Prof. David Stupples teaches electronics and radio engineering at the City University of London, and specialises in research and development of radar systems and electronic warfare.

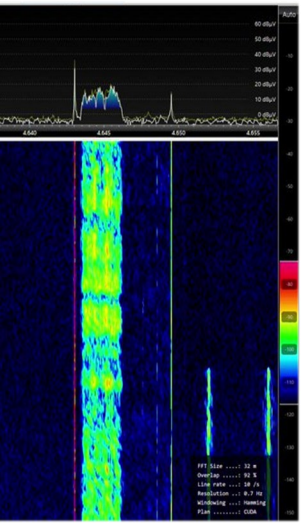
"The Buzzer", is a shortwave radio station that broadcasts at a frequency of 4,625 kHz. It broadcasts a short, monotonous buzz tone, repeating at a rate of approximately twenty-five tones per minute, 24 hours per day. Sometimes, the buzzer signal is interrupted and a voice transmission in Russian takes place.

For the past 40 years, ever since the peak of the Cold War, a bizarre radio signal has confounded scientists and radio operators worldwide. According to an old BBC article, the source of the signal is near St. Petersburg, Russia, and is believed to be the headquarters of a radio station called 'MDZhB' (Russian: УВБ-76). Despite the station's continuous 24/7 broadcast of a monotonous tone on the frequency 4625 kHz, no one has ever claimed responsibility for it. Occasionally, a human voice interrupts the signal to read words like "dinghy" or "farming specialist," adding to the mystery. It was further reported that enthusiasts who explored the original location in Russia allegedly discovered a logbook documenting the messages transmitted by UVB-76.

A Cold War Relic with Modern Mysteries

These transmissions have been studied and analyzed by Professor David Stupples, who teaches electronics and radio engineering at the City University of London. Stupples specializes in research and development of radar systems and electronic warfare. For a number of years, he undertook research in this area at the Royal Signals and Radar

Establishment (RSRE) at Malvern in the UK, followed by surveillance and intelligence systems research for the UK Government. He then spent three years developing surveillance systems and satellites for Hughes Aircraft Corporation in the US.



According to Stupples: "One thing is certain, it is almost certain that the Russian government is using this signal. If it was the Russian government, it would not be for peaceful purposes." Wilder speculation has also emerged. Some believe that this signal is the trigger for the end of the 'Dead Hand,' which would launch nuclear weapons if Russia's leadership were incapacitated.

This signal first attracted attention in 1982 and became even more strange in 1992, with peculiar sounds and unexplained codes. The Buzzer operates at an HF frequency, which allows it to travel great distances. Initially, UVB-76 was believed to be part of the Soviet Union's vast communications network. After the dissolution of the Soviet Union in 1991, the transmission continued to operate from Russian territory. The feed has gained many followers online, where users call it "The Buzzer". There are various theories surrounding the radio transmission. The frequency is thought to belong to the Russian military, though they have never officially admitted so.

In 2010, the source of the signals moved from a military base near Povarovo, about 30 kilometres outside Moscow, to a new location believed to be near Pskov, on the border with Estonia. This change saw alterations in broadcast patterns, including random voices and mysterious repeatable codes.

There are those who believe UVB-76 is a numbers station used for sending coded messages to spies and operatives. The cryptic voice messages fit the pattern of traditional numbers stations, which have been used for decades by various countries for espionage purposes. Another theory suggests that UVB-76 might be related to ionospheric research, helping to study radio wave propagation through the Earth's atmosphere. This would explain the consistent signal and occasional variations; but if so, why the secrecy? The most far-fetched theory is that this signal is part of a secret Search for Extra-terrestrial Intelligence [SETI] program of the Russian government or is even communicating with visiting alien species.

Despite various efforts by amateur radio researchers and scientists to decipher the meaning of this signal, a definitive answer remains elusive. According to Professor Stupples, without official confirmation from the Russian Federation, the truth behind this signal may remain a mystery. "This is always interesting, isn't it?" Stupples told Popular Mechanics. "And you never know, one of those strange views may be true, and we all have to accept the harsh reality."

In recent years, UVB-76 has undergone changes that have reignited interest and speculation. In 2010, a significant spike in activity included more frequent voice messages, leading to renewed interest from amateur radio enthusiasts and conspiracy theorists alike, as per Popular Mechanics. Despite extensive monitoring and analysis by enthusiasts worldwide, the exact purpose of UVB-76 remains unconfirmed, perpetuating its status as one of the most compelling unsolved mysteries of the shortwave radio world.

~

See and hear the Buzzer on YouTube

Ground

…is something you stand on

by JOHN SCHOUTEN VE7TI with inspiration from KRISTEN McINTYRE K6WX

Ground is something you stand on, but in an electrical sense, the meaning is much less clear. When it comes to hams and ground, things get really confused. We drive rods into the earth, but why? Let's take a look at whether any of this makes sense, and what theory tells us about "ground," and if it exists in any sensible way at all. We'll talk about DC grounds, RF grounds, and even about gravity.

The foregoing was the description of a presentation at the Dayton Hamvention this year. Kristen McIntyre K6WX, ARRL First Vice President provided a comprehensive overview entitled: Understanding Ground in Electrical Systems: An Overview for Ham Radio Operators", that is available on YouTube.

Kristen at Hamvention 2024

Ground is a concept that everyone is familiar with in a physical sense, as it refers to the earth beneath our feet. However, in the realm of electrical engineering and ham radio operations, the term "ground" takes on a more complex and sometimes confusing meaning. So what's ground in those terms… just a common reference between two things. This technical overview aims to clarify the concept of ground, its various types, and their significance in ham radio operations, as discussed in the 2024 ARRL National Convention track.

The Theory Behind Grounding

Grounding is essential for both safety and performance in electrical systems. The theory of grounding is based on creating a common reference point for voltages within a system, which helps stabilize the system and prevent unexpected voltage spikes.

Grounding and Gravity

The concept of grounding can even extend to discussions involving gravity, especially in theoretical and practical physics. Ground, in a physical sense, is a reference point relative to the gravitational pull of the earth. Similarly, in electrical systems, ground serves as a reference point for electrical potentials. While the analogy between gravity and electrical ground is not perfect, it highlights the importance of having a stable reference point in both contexts.

Types of Ground

1. Safety Ground

A safety ground refers to a common return path for electric current, typically involving a physical connection to the earth. This type of grounding is essential to ensure that, in the event of a fault, electrical current can safely dissipate into the earth, reducing the risk of electric shock and equipment damage.

In DC systems, grounding provides a path for fault currents to safely dissipate into the earth. This is critical in preventing electric shocks and reducing the risk of fire.

2. RF Ground

RF (Radio Frequency) ground is crucial for ham radio operations. It involves creating a low-impedance path for radio frequency currents, which helps in minimizing electromagnetic interference (EMI) and radio frequency interference (RFI) by providing a low-impedance path for high-frequency currents. This can reduce noise and improve the efficiency of antenna systems and thereby improves the overall performance of radio transmitters and receivers.

RF grounding can be more complex than DC grounding because it often requires special techniques and materials to ensure proper operation at high frequencies.

Grounding Rods

Grounding rods are physical rods driven into the earth to provide a reliable connection to ground. These rods are typically made of conductive materials such as copper or galvanized steel. The effectiveness of grounding rods depends on the soil composition, moisture content, and the depth at which they are driven.

Ham radio operators often face challenges in achieving effective grounding. Here are some practical tips:

1. Grounding Rod Installation

Ensure grounding rods are installed to a sufficient depth, ideally in moist soil, to improve conductivity. The addition of Bentonite *[Communicator issues from 2021 and 2024 describe its use]* can improve ground conductivity. Multiple rods can be connected in parallel to enhance grounding effectiveness.

2. Ground Radials

For RF systems, using ground radials (wires laid out on the ground in a radial pattern) can improve grounding efficiency for antennas. This technique is particularly useful for vertical antennas.

3. Regular Maintenance

Grounding systems require regular inspection and maintenance to ensure their effectiveness. Corrosion and changes in soil conditions can impact the performance of grounding rods and connections.

Understanding the concept of ground in electrical systems is crucial for ham radio operators and anyone involved in electrical engineering. Whether dealing with DC or RF systems, proper grounding ensures safety, reduces interference, and improves performance. The discussions and insights provided during the 2024 ARRL National Convention track offer valuable knowledge to enhance our understanding and application of grounding in various contexts.

For a deeper dive into the topic, including K6WX's practical demonstrations and theoretical explanations, you can watch the related video on YouTube: Ground is a Myth!

Ground in Electrical Systems. This video provides a comprehensive overview of grounding principles and their practical applications.

~ John VE7TI

Heathkit of the Month

#23: Heathkit HD -1416 Code Practice Oscillator.

by BOB ECKWEILER, AF6C

The first electronic project I ever built as a kid was a code practice oscillator; the year was around 1957. The plans came from Popular Electronics, and it used a single Raytheon CK-722 germanium PNP transistor. Transistors were quite new on the market, and expensive portable transistorized radios in their leather cases were all the rage. Taking a portable radio to the beach no longer meant lugging large units with tubes and large “B” batteries.

My first code practice oscillator had just a few components, but it would drive 2,000-ohm ear phones at a decent volume and had a clean tone. It ran off a pair of AA batteries as I recall. I used it to learn the code and get my novice ticket in 1959.

Figure 1: The CK-722 Transistor. Photo courtesy of N4MW

Jump ahead some fifty-three years and I acquired another code practice oscillator (CPO); it was at the OCARC auction, and of course it was a Heathkit! The HD-1416 CPO.

Heathkit manufactured Three different models of transistorized code practice oscillators over the years. The first was the CO-1 which was manufactured between 1959 and 1967. In 1967 Heath replaced the CO-1 with the HD-16. Then in 1975 Heathkit introduced the HD-1416 which, over its life, was updated twice to the HD-1416A and the HD-1416H (case color changes only). All the Heathkit models came with a simple telegraph key.

The Heathkit CO-1

Heath’s first code practice oscillator, the CO-1 (figure 3) uses a single 2N238 germanium PNP transistor, not too different from the CK-722. A socket was used to hold the transistor, reflecting the fragile state of the early transistor. Figure 2 shows the simple circuit.

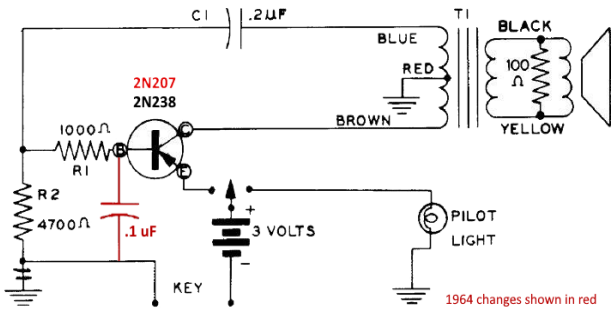


Figure 2: CO-1 Schematic with changes

Notice that the CPO drives a speaker and has a switch that allows sending code using a light instead of a tone. The oscillator produces a tone around 1,000 Hz. A pair of "C" batteries power the CO-1. The CO-1 measures 6" x 3" x 2-1/8". The panel has a small speaker grill, a switch to choose light or tone, a small #14 pilot lamp for the light and screw terminals for a key.

Later in the production of the CO-1 (February of 1964) Heath made a design change to the CO-1. They changed the transistor to a 2N407 and added a 0.1 µF disc capacitor between the base of the transistor and ground - evidently to reduce key-clicks. The model number was not changed, but an addendum was supplied with the manual as were the new parts. I have that addendum sheet if anyone is looking to upgrade their early CO-1. The circuit changes are shown in the figure 2 schematic of the CO-1 in red.

Figure 3: Heathkit CO-1 CPO - Photo courtesy of N4MW

The Heathkit HD-16

By 1967 the unijunction transistor had been introduced and became popular for a lot of oscillator devices. Heathkit took this opportunity to introduce a new CPO. The HD-16, shown in figure 4, utilizes a single unijunction transistor oscillator. The schematic is shown in figure 5. It uses a rather obscure GE 4JX5E670 transistor, which I believe is similar to the later popular 2N2646.

Figure 4 - The Heathkit HD-16 Code Practice Oscillator

Like it's ancestor, the HD-16 drives a speaker and can be switched to drive a lamp instead of a tone oscillator. The case has a sloping front (quite similar to the first case I built my CK -722 CPO into) and is styled after the SB ham line color scheme of green and grey. The #49 light is on top of the case, the high impedance (150Ω) speaker and light - tone switch are on the sloping front and the volume and tone controls, as well as 1/4" phone jacks for the key and phones are on the vertical part of the front panel. The HD-16 uses three batteries, two NEDA 1604 9V batteries for the oscillator circuit and one 1.5 volt 'C' battery for the lamp.

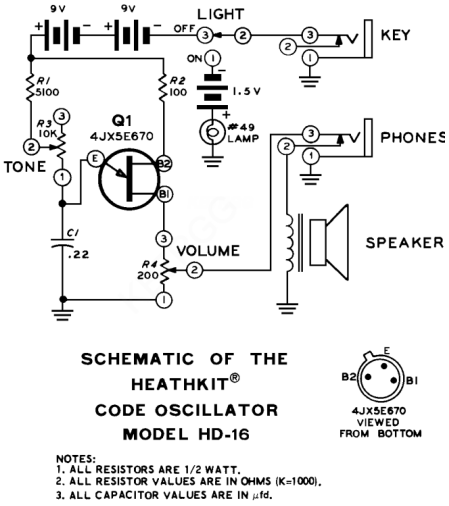


Figure 5 - HD-16 Schematic

The Heathkit HD-1416

The HD1416 was introduced in 1975. It is a three-transistor circuit using two transistors as a multivibrator, and one transistor as a class A audio amplifier. The unit is built into a small plastic case with a metal front panel. A

Figure 6 -The HD-1416 CPO

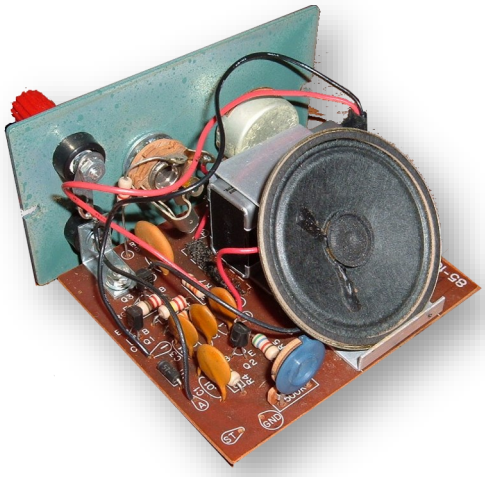


Figure 7 - The HD-1416 Less Case.

printed circuit board mounts off the front panel on a small angle bracket. The back of the case is open, and the speaker, mounted in an aluminum bracket, at an angle to horizontal, bolts to the circuit board.

The HD-1416 is powered by a 9-volt NEDA #1604 battery that mounts in the speaker bracket, held by four pieces of foam tape. Additional foam tape is located under the board to support the back of the printed circuit board.

The transistors used in the oscillator are a pair of 2N5249A silicon NPN transistors; the class-A audio amplifier uses an MPS-A20. A feature of the HD-1416 is that the keying arrangement allows it to be used with a ham transmitter using grid block keying (up to -400 volts), which most of the Heathkit transmitters/transceivers of the time utilized (such as the SB-400/401, HW-100/101, SB-100/101 to name a few). The front panel is very simple with a 1/4" phone jack for phones, a volume control and two binding posts (red and black) for the key. A circuit board mounted control, easily accessible from the open back, of the cabinet, adjusts the tone from about 200 to 850 hertz. Unlike previous models, light for visual Morse code is included with this CPO. The telegraph key continues to be provided.

In late 1985 Heathkit introduced the HD-1416A with a brown case and black binding posts for the key. In 1989 Heath again changed the color to black and designated the CPO the HD-1416H.

The HD-1416 originally sold for $9.95, in 1975, which is the same price that the CO-1 and HD16 originally sold for. During the early eighties the price jumped to $13.95 (Christmas 1980 catalog), $14.95, (Christmas 1981) $16.95 (spring/summer 1982), $22.95 (winter 1983) and $24.95 (Christmas 1983). In 1985 Heathkit introduced the HD-1416A and dropped the price to $19.95 (fall 1985); it was back to $24.95 by the time the HD-1416H came out in 1989. That is the last price I have for the HD-1416H before Heathkit quit the kit business.

Restoring the HD-1416

This is a simple kit. The one picked up at the club auction did not work when I got home; also, the speaker was loose, as was the circuit board. Removing the unit from the case revealed a missing screw from a bracket that mounts off the lower banana jack. Another problem, probably the biggest, was that the five pieces of foam strips that hold the battery and help support the circuit board had dissolved into a gooey mess. It was carefully cleaned up with rubber cement thinner (hard to find now-a-days but a great solvent for lots of adhesives). The circuit board was examined and a wire from the earphone jack to the board was found to be broken. It was replaced. Finally, new closed cell foam, normally used to insulate windows, was trimmed to replace the original foam. No specifications or size could be found on the original foam other than the Heathkit part number 73-39. A "best guess" was used to trim the sizes. Reassembling the kit; installing a used 9-volt battery and attaching a key (The original key was not included in the auction sale) resulted in a sweet, though harmonic note of CW as the key was operated.

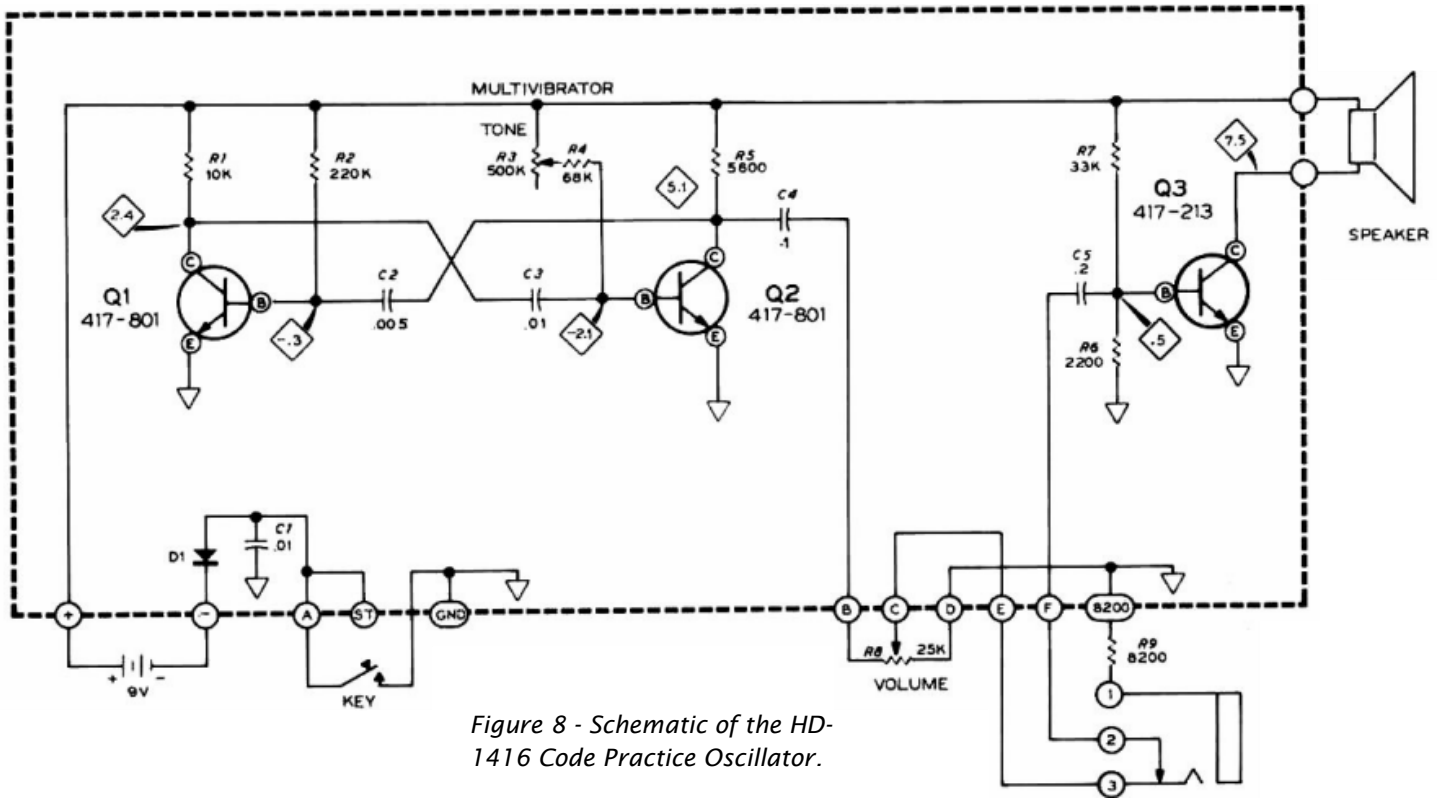


Figure 8 - Schematic of the HD-1416 Code Practice Oscillator.

Tube Code Practice Oscillators (Ameco, Bud and Gonset)

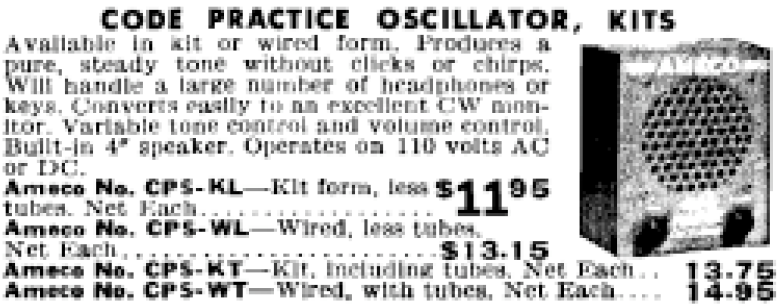
Before Heathkit ever put out a code practice oscillator there were numerous other manufacturers who produced numerous models. In the fifties and even into the seventies four tube-based models were very popular in the ham world.

Bud Radio manufactured two of the units, the Codemaster CPO-128A for $19.13 and the Codemaster CPO-130A for $16.50 (1962 prices). The two units were identical except the 130A required an external speaker. Bud also manufactured some variants of these models.

Ameco (American Electronics Company) manufactured the CPS that was available as a kit (-K) or built (-B) and with (T) or without (L) tubes; the price ran between $11.95 for a kit without tubes to $14.95 for a built unit with tubes. Ameco also made code records and later code tape cassettes for learning CW.

Gonset manufactured the Monitone #3022 ($32.80 in 1962). It was similar to the other units but built to match their line of ham equipment.

All 4 units use a 35W4 rectifier and a 50C5 audio amplifier vacuum tube and run off 117 V AC/DC. They all feature a 4" speaker except the Bud CPO-130A. The Bud and Gonset units came ready to use as an on-the-air CW monitor; the Ameco CPS had instructions to modify the unit to add this feature (losing the normal feature). The differences in price reflect the different components. While the inexpensive Ameco unit uses screw terminals for the key and phones, the Gonset unit has phone jacks and a rotary switch to select the function as either a CPO, a CW monitor or an AM monitor.



CODE PRACTICE OSCILLATOR, KITS

Available in kit or wired form. Produces a pure, steady tone without clicks or chirps. Will handle a large number of headphones or keys. Converts easily to an excellent CW monitor. Variable tone control and volume control. Built-in 4" speaker. Operates on 110 volts AC or DC.

Ameco No. CPS-KL—Kit form, less tubes. Net Each..... **$11.95**

Ameco No. CPS-WL—Wired, less tubes. Net Each..... **$13.15**

Ameco No. CPS-KT—Kit, including tubes. Net Each.. **13.75**

Ameco No. CPS-WT—Wired, with tubes. Net Each.... **14.95**

Figure 9 - Early Ameco ad for their CPS Code Practice Oscillator from an early sixties—Arrow Electronics Catalog

Early on, the Ameco and Bud units were a shock hazard because the rectified line voltage (about 140V) was present on the key terminals and contact with it while touching a grounded radio would give a good shock. Both units were updated during their production to put the key in the speaker lead and eliminate the shock hazard. Bud changed the part number to the CPO-128B, but Ameco kept the original part number.

The Code Practice Oscillator Museum

Since this is a Heathkit series, we just touched the surface of the many other CPO manufacturers and models. On the web, Dave - N4MW masters the excellent Code Practice Oscillator Museum website. There, numerous code practice devices are detailed; Dave has over three hundred in his collection. You may visit his virtual museum at: http://www.n4mw.com/cpo.htm

Dave has graciously allowed me to use some of the photos from his website, including a photo of the classic CK-722 transistor.

~ 73, from AF6C

This article originally appeared in the November 2010 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE. Re-published with permission from the author.

If anyone has access to Popular Electronics of the mid to late fifties, I'd really enjoy finding the code practice oscillator article that used the CK-722. and that I built way back then.

Remember if you come across any old Heathkit Manuals or Catalogs that you do not need, please pass them along to me.

Thanks - AF6C

A recent Saturday Denny's group. Come join us!

A Special Interest Group for the iCOM 7300, 7610, 9700 and compatible models

Setting perfect audio

by JOHN SCHOUTEN VE7TI based on a video by MATTHEW KASKAVITCH K0LWC

The IC-7300 comes with the HM-219 hand microphone. Despite its small size, this stock microphone is well-engineered, has a Heil element, and provides excellent audio quality, receiving many positive reports on the air. If you don't need hands-free operation, the HM-219 is an excellent choice, designed to work seamlessly with these iCOM transceivers.

If you use an alternate mic, you may need to adjust the audio characteristics. In amateur radio, because audio bandwidth is limited, microphone gain and compression play crucial roles in achieving optimal audio quality during transmission.

What is mic gain?

Mic gain controls the sensitivity of your microphone. It determines how much the radio amplifies the audio signal from your microphone.

To set the mic gain on your transceiver, adjust the control to achieve the right balance. Too low, and your audio may be weak; too high, and you risk distortion. Remember, you don't want to overmodulate as that causes distortion and interference.

Set the mic gain and compression on your ICOM 7300/7610 or 9700 so you can achieve the best sounding audio and maximize your output power. If you think turning all the meters to the far right is the way to go, you could end up with very distorted audio. So why does this happen?

iCOM radios are known for inducing distortion when compression is cranked up to a high level. Additionally, if you're maxing out the Automatic Level Control (ALC), you're likely cutting down your power output and not getting the full 100 watts.

Whether you're using a boom microphone with a dynamic element or the stock hand microphone, the steps are the same. The only difference lies in the starting values. Here's what you need to do:

- Turn off compression and set it to 0.
- For a dynamic mic, start with 40% mic gain. The stock mic has a Heil element and sounds great on the air. If you have the stock hand microphone, start at 10%.
- Position yourself about 1½ to 2 inches away from the microphone.
- Speak in a normal tone of voice at a regular level—no screaming or whispering.
- Observe the ALC meter. You want it to indicate about 30 to 40% with no compression turned on.
- Avoid pushing the ALC into the red zone.
- Slowly increase the mic gain until you reach that point. Once you hit it, you're in the sweet spot.

Proper mic gain ensures clear audio without distortion.

What is compression?

Compression enhances audio by controlling dynamic range. It boosts softer sounds and limits louder peaks.

If it is off, turn on compression and set it to 1. You'll notice that your ALC should jump to about 75 to 85% on the meter, and your sound will drastically improve. This cleaner audio will allow

(Continued on page 36)

iCOM Meter Display Selection

IC-7300 user manual page 3-10

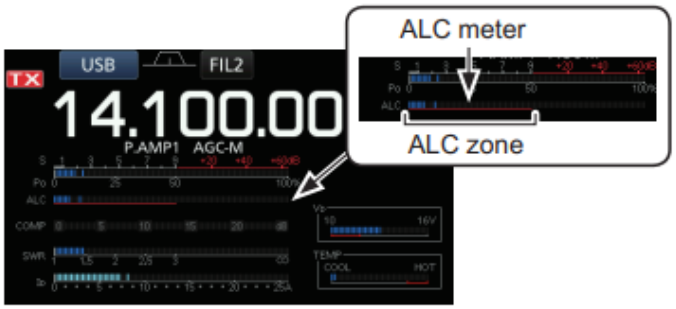
You can display one of the 6 different transmit parameters (Po, SWR, ALC, COMP, VD and ID) for your convenience.

Touch the parameter to display one of the meters.

◇ Multi-function meter

You can display all the parameters simultaneously.

Hold down the parameter for 1 second to display the Multi-function meter.



Multi-function meter

S:	Displays the receiving signal strength level.
Po:	Displays the relative RF output power.
SWR:	Displays the SWR of the antenna at the frequency.
ALC:	Displays the ALC level. When the meter movement shows the input signal level exceeds the allowed level, the ALC limits the RF power. In such cases, decrease the microphone gain level.
COMP:	Displays the compression level when the speech compressor is used.
VD:	Displays the drain voltage of the final amplifier MOS-FETs.
ID:	Displays the drain current of the final amplifier MOS-FETs.
TEMP:	Displays the temperature of the final amplifier MOS-FETs.

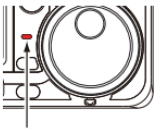
Setting Microphone Gain

IC-7300 user manual page 3-10

Adjust the microphone gain as described below.

1. Set the operating mode to SSB, AM or FM. (p. 3-2)
2. Push MULTI to display the Multi-function menu.
3. Touch "MIC GAIN."

4. Push TRANSMIT or hold down [PTT] on the microphone.
   • The TX/RX indicator lights red and TX is displayed.


Lights red

5. Rotate MULTI to adjust the microphone gain.

ⓘInformation

- In the SSB mode, touch the TX meter to select the ALC meter and adjust until the meter reading swings between 30 to 50% of the ALC scale.
- Hold the microphone 5 to 10 cm (2 to 4 inches) from your mouth, then speak at your normal voice level.
- In the AM or FM mode, check the audio clarity with another station, or use the Monitor function (p. 4-8).

6. Push TRANSMIT or release [PTT].
   • Returns to receive

Setting the Compression Level

IC-7300 user manual page 4-9

SSB mode

The Speech Compressor increases the average RF output power, improving readability at the receiving station. This function compresses the transmitter audio input to increase the average audio output level.

ⓘThe function is effective for long-distance communication, or when propagation conditions are poor.

Setting the Compression Level [continued]

1. Select the SSB mode. (Example: USB)
2. Push FUNCTION.
   • Opens the FUNCTION screen.
3. Be sure that the Speech Compressor is OFF.
   ⓘIf the Speech Compressor is ON, touch [COMP] to turn it OFF.

FUNCTION screen (USB mode)

4. Touch EXIT to close the FUNCTION screen.
5. Touch the Multi-function meter to display the ALC meter.
   ⓘTouching the Multi-function meter sets the meter to Po, SWR, ALC, COMP, VD or ID.

ALC meter

6. Adjust the MIC GAIN (p. 3-10) to where the ALC meter reads within the 30 to 50% range of the ALC zone.
7. Touch the Multi-function meter again to display the COMP meter.
8. Push FUNCTION.
   • Opens the FUNCTION screen.
9. Touch [COMP] to turn it ON.

Setting the Compression Level [continued]

10. Touch [COMP] for 1 second.

11. While speaking into the microphone at your normal voice level, adjust the Speech Compressor level to where the COMP meter reads within the COMP zone (10 to 20 dB range).
ⓘWhen the COMP meter peaks exceed the COMP zone, your transmitted voice may be distorted.

(Continued from page 34)

you to achieve the full 100-watt peak power. Remember, don't push the ALC to 100%—this radio aggressively cuts power at that point.

With a compression level of one and about an inch and a half away from the microphone, you will likely hit 75-80% ALC, which is the sweet spot for voice. This setup is ideal for rag chew conversations. Keep in mind that you don't need to keep it like this all the time but it's a great starting point. Most microphones work well with just a touch of compression. Setting the compression:

- Start with compression off (set to zero).
- Once mic gain is optimized, turn on compression.
- Set compression to an appropriate level (e.g. 1).

Again, avoid pushing ALC to 100%, as aggressive ALC can reduce power output. The result should be clean, punchy audio with improved intelligibility. Remember, finding the right balance ensures great audio quality for your fellow hams!

Enjoy your clean audio!

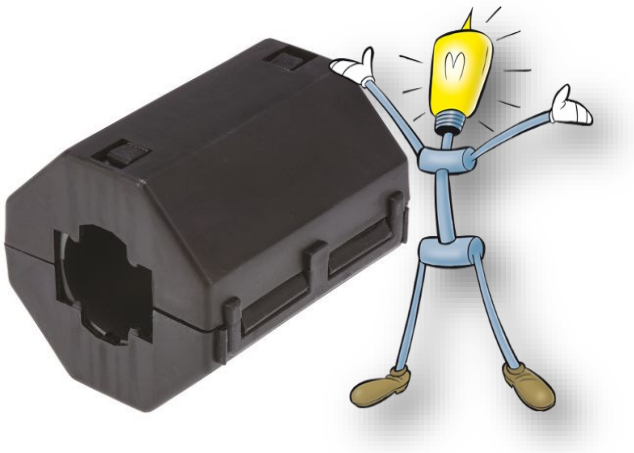
~

Here is Matthew's video: Icom 7300: How to Properly Set Mic Gain. You may also enjoy iCOM 7300: Dynamic Microphones & Preamps

My wife's Maytag clothes-washer on 10-meters sounds like Soviet Union era KGB jamming…. And that makes this band unusable.

Wind as many turns as possible of the washing machine power cord around a Fair-Rite Mix 31 core, part #2631181381.

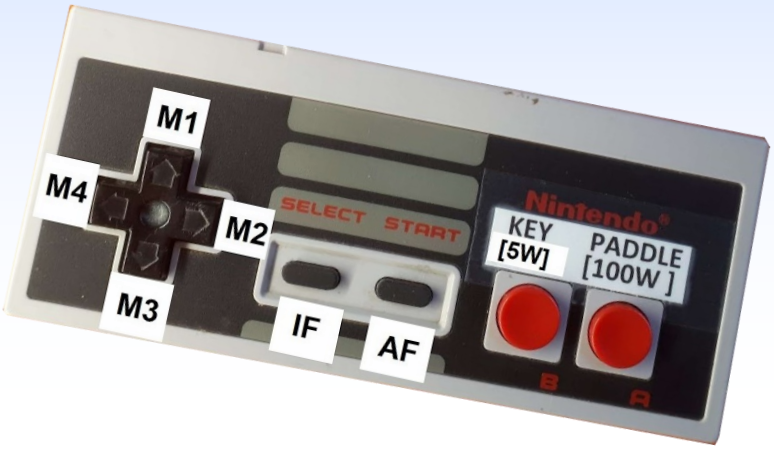
This is a very large core so you should be able to get at least 6 turns through it. It costs about $20 for one core.



IC-7300 Paddle or Key?
An easy solution with Arduino!

Instant switching between key and paddle, and setting two power levels without even touching my rig!

by LUC DECROOS ON7DQ



Since a couple of months I am the proud owner of an Icom IC-7300.

It's a wonderful rig, designed as a direct sampling SDR transceiver, with all sorts of bells and whistles, a user friendly touch screen and so much more... for a very low price.

But that is not why I am writing this.

The most important thing that annoyed me from the start is that the iCOM designers clearly hadn't thought about the versatile CW operator.

When you are like me, and switch from paddle to straight key fairly often, you will be disappointed with this rig. On their more expensive rigs, Icom have put a straight key input on the back , and another one on the front for a paddle (labeled ELEKEY). The IC-7300 is of course a lower cost rig, but the Kenwood TS-590SG is about the same price, and it does have two keying inputs!

Now, what exactly is the problem? You can wire a key and a paddle in parallel to the KEY input on the back, right? Problem solved?

NOT SO!

You still have to punch in 8 (yes EIGHT) keys on the rig (or on the touch screen), each time you want to change from paddle to key or vice versa. (For those who do not even know how to do this… press MENU> KEYER> EDIT/SET> CW KEY SET> TYPE

[above] Version two; [below} Version one

KEY> Select KEY or PADDLE> EXIT> HOLD M.SCOPE… that's all, hi).

And as you can see, it's also very confusing that you have to go via the memory keyer screen, and not via the normal MENU > SETTINGS >… as you might expect.

Also… no programmable PF keys on this rig…

Now, being a great Arduino fan, I thought there had to be an easy solution.

Most Icom HF transceivers and some receivers can be controlled via the so-called CI-V bus.

The IC-7300 even has two such CI-V busses, one is incorporated into the USB connection to the PC, and there is also a "classic" CI-V connector (3.5mm).

I have used the latter for my project , leaving the USB connection for CAT control (log program, digimode program, etc ... and for the built in soundcard of course).

The CI-V bus

To understand how our Arduino project works, first a brief introduction to the CI-V bus.

I got a lot of information from Jean-Jacques, ON7EQ (see: http://www.qsl.net/on7eq/en/ , then >Projects> Arduino), and also from the "Bible of CI-V" written by Ekki, DF4OR

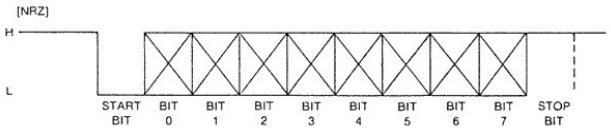
(see http://www.plicht.de/ekki/civ/index.html).

CI-V stands for Computer Interface 5, and is already in use with Icom transceivers since the eighties.

It is a single wire bus at TTL level, the jack is a 3.5 mm stereo plug of which only the TIP and the SHIELD are used. For control from an RS-232 port (PC) an interface is needed (eg. using a MAX232), but this is not necessary with the Arduino, since we are working at TTL level.

In the idle state, the bus is high, or "floating" (+ 5V). If the computer wants to send something, the bus is pulled low by the computer, if the transceiver sends something, it will pull the bus low.

The format of the data is NRZ (Non Return to Zero).



NRZ Format (source: Icom CI-V Manual)

Now, what do we need for this project ?

We want only to send some bytes from the "controller" (the Arduino) to the rig, and not listen to what comes back. Each message to the transceiver is composed of a fixed number of bytes, and some command bytes with or without extra data bytes (a frequency, a text, a status).

A message always starts with twice $FE ($ or 0x is the prefix for a hexadecimal number).

Then follows the address of the transceiver, for an IC-7300 is this example $94.

After that comes the controller address, which is always $E0 (and it is never actually used in the transceiver). Now it is time for the command, if needed a sub-command, and finally the data bytes.

To conclude the message, the last byte sent is $FD, and then the transceiver is ready to receive the next message.

There is still a small problem with the data bytes, these should not be sent in hex, because there is a chance that the data would contain a byte like $FE or $FD (the start and stop codes). Therefore, all data must be sent in BCD format. A number like 123 is then converted into $01 $23. Not difficult, but you have to think about it.

A few examples may make all this complicated stuff a little easier to understand:

Set Mode:

$FE $FE $94 $E0 $06 $00 $FD = put the transceiver in LSB MODE

$06 is the mode set command, $00 = LSB, $ 01 = USB etc… you can find all the modes in the full manual of your transceiver or on the site of DF4OS.

Set USB AF / IF:

$FE $FE $94 $E0 $1A $05 $00 $59 $00 $FD: put the USB port output (signal going to the PC) in AF mode, with $01 you set the IF mode. This again saves five keystrokes on the transceiver!

[Note: if you haven't used this feature of your 7300, it's great fun!]

With the USB port in IF mode, you send 24 kHz of received signal to the PC, which can use it in any SDR program. One thing I use it for, is listening to DRM (Digital Radio Mondiale) with the DReaM software, and without using any additional hardware (converters etc)

Set Power:

$FE $FE $94 $E0 $14 $0A $00 $28 $FD: put the TX power at 10 W

$FE $FE $94 $E0 $14 $0A $02 $55 $FD: put the TX power at 100 W

The power is actually expressed as a percentage. The data ranges from 0 to 255, for 10 Watts you would have to send 10%, or about 255 x 0.10 = 26. In a test, I found out that 28 is nearer to 10W.

For 5W, 7% is about right, so send 255 x 0.07 = 18.

This feature saves the endless rotations with the multi-switch, it will certainly prolong it's life…

I have included this in my project (in the extended code)… and it uses no extra buttons! (see code).

With a long press on the KEY or PADDLE button, the power is set to 10 or 100 watts respectively.

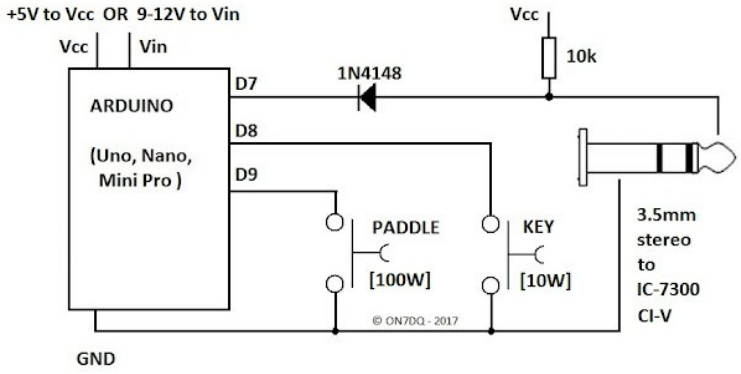
If you have the courage to read the full manual (it's on the CD supplied with the rig), you will find more interesting commands in chapter 19.

TIP: if you want to test if a command does what you want it to do, DF4OS has written a nice Windows application: the CI-V Tester.

You can download it here: http://www.plicht.de/ekki/software/civtest.html.

The Arduino Hardware

The circuit can not be simpler:



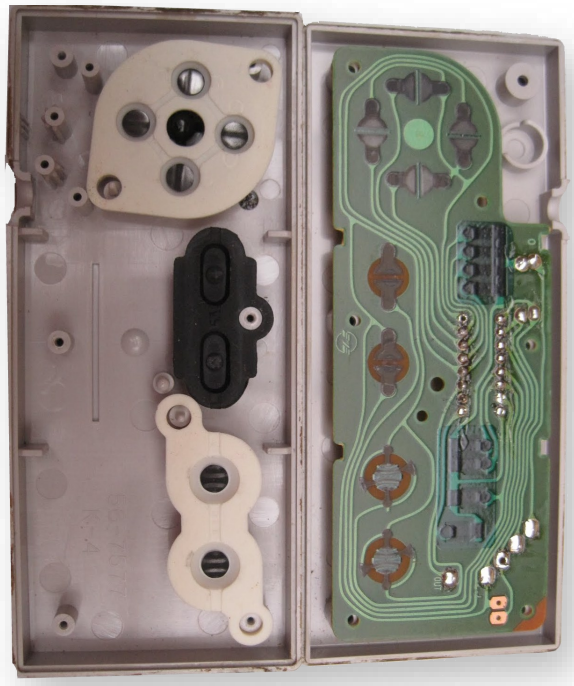
- an Arduino UNO, or one of the smaller variants (Nano, or Pro Mini), one diode, a resistor and two push buttons
- a 3.5 mm jack with a shielded cable end

NOTE: Vcc means the 5V pin on an Arduino board, and if you power the Arduino via the USB input, you still need to connect the 10k resistor to the 5V pin on the Arduino.

Add one more resistor if you want to read back the reply from the rig (not used in this project), put 4k7 from the TIP of the 3.5 mm connector to an interrupt capable pin (D2 or D3).

Put it in a box !

Now being a very simple project, I still wanted it to be in a nice enclosure.



In my junk box I found this old Nintendo controller with two red buttons… perfect!

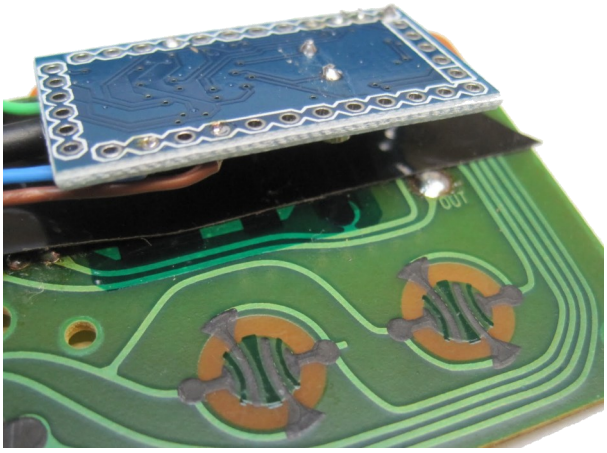
Inside was a printed circuit board with an 8-bit shift register (for the 8 buttons). I removed the chip and so I had nice solder pads for every button in the box.

I'm using only the two red buttons for now, but I can easily expand the project to use the other buttons *[read on]*, just adding the wires and some lines of code… that's it!

Due to the limited space in the box, I used an Arduino Pro Mini without pins, it fit just below the original PCB. The necessary wires were soldered directly to the Arduino. Some adhesive tape ensures that no short circuits occur.

Anyone building this project and putting it in a nice case? Send me a pic and I will gladly put it on this page! (my address is on QRZ.com)

Here a detail of the assembly inside, with the two "carbon" switches.



Arduino Software

If you ever programmed an Arduino , you know that an Arduino program is called a sketch. A sketch is written in a special dialect of the C language, with the use of libraries in C++.

A sketch always consists of three parts: first the declarations, then a setup() function and finally a "loop()" function. The latter continues to run forever… until you disconnect power.

Both the setup and the loop can call additional functions, for example in this project. the function blink(), which makes the built-in LED flash briefly for each press of a button.

(Not very useful in my case, since I can't see that LED, hi, but I could wire an extra LED and mount it in the top of the box).

All in all, the code is very straightforward, this is really a beginners project. Everything should be clear from the added comments (after the // characters).

I made two versions of the sketch, a very simple one for those that only want the

Here a picture of the finished product

paddle/key switch. Then a longer one for detecting short/long press and do the power switching.

Conclusion

Of course you can extend the hardware and software with the other commands that we discussed, it's just a matter of some extra wires, buttons and some lines of code.

The first extension that I made (setting 10W/100W) can already be seen in version 2 of the code.

I use this for quickly tuning a manual tuner or a magnetic loop, while the IC-7300 autotuner is bypassed.

Another idea I had was making this project fully "auto-sense".

If you briefly touch the paddle, the transceiver would switch to paddle input, ditto for the key.

I tried this, but there is obviously a problem. The contacts for the DITS and the STRAIGHT KEY are wired in parallel. From the first DIT that you send, the Arduino will see this for a "straight key press" and will switch back to key input mode.

Now this can be solved by connecting paddle and key through your Arduino box, and switching them with a relay, so that the Arduino only "looks" to the contact which is not "in use" (the other device is then connected to the rig).

This was soon to be a complicated thing, and I left the idea for what it was… just an idea , hi. Some other idea I had was interesting enough… how about four more buttons to send the first four memories in the memory keyer?

Well… I didn't find any command to do this!

Apparently there are CI-V commands to program the text into the memories (I guess those are meant to be used from a contest program on the PC).

EDIT: N1MM found out that the IC-7610 had those commands, and that they also worked on the 7300 as well , they just were not documented in the 7300 extended manual.

The command structure is as follows (from the N1MM+ help file):

28 00 00~08 Voice TX Memory (00=Stop, 01=T1 to 08=T8)

BUT another BIG DISAPPOINTMENT: this works only for the voice keyer messages, not for the CW messages… what a bummer!

UPDATE on this EDIT: The commands are now also documented in the 7300 Extended manual, version 8. In the manual there is of course a circuit to make a 4-button "keyer" box, but the software solution can send all 8 memories.

IC-7300 Paddle <> Key Switch Revisited

I have been using this mini controller for my IC-7300 almost daily since I first published it in 2017.

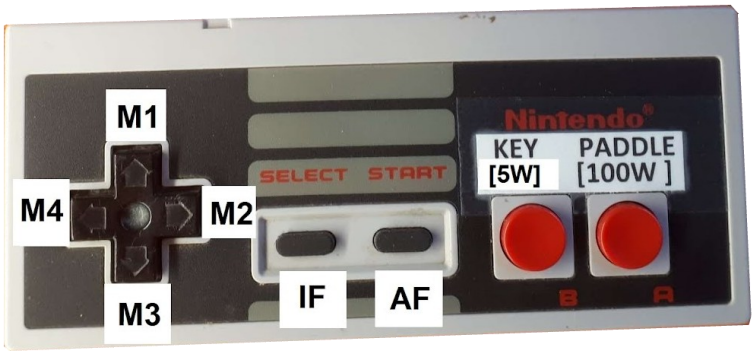
See: https://on7dq.blogspot.com/2017/02/ic-7300-paddle-or-key-easy-solution.html

It's still the most read post on my blog.

So far, I had only used two of the 8 buttons in the "antique" Nintendo Controller.

I'm still working on my "Big Controller" (see Part 1), but that project is going nowhere for the moment.

Version one revisited: This is version two



So, recently I decided to "upgrade" my mini project, add some wires to the remaining 6 buttons, and write some more code for it. At the same time I changed the LOW POWER to 5W since I regularly do some QRP operation (NOTE : In my IC-7300 5W corresponds to 7% on the power scale).

And I added a 4-wire connection to program the Pro Mini, without opening the box.

The original circuit of those Nintendo Controllers contained a CMOS IC, type 4011.

This is an 8-bit static shift register.

But since I needed the space for my small Arduino Pro Mini, I removed that IC and used the solder pads to connect my wires to the Arduino. For those interested, I made the following connections:

Nintendo button	4011 pin number	Arduino input	IC-7300 Function
A	1	D9	PADDLE [100W]
B	15	D8	STRAIGHT KEY [5W]
START	13	D10	USB OUT = AF
SELECT	14	D11	USB OUT = IF
UP	4	D2	SEND VOICE MEMORY 1
RIGHT	7	D3	SEND VOICE MEMORY 2
DOWN	5	D4	SEND VOICE MEMORY 3
LEFT	6	D5	SEND VOICE MEMORY 4

The new version of the Arduino sketch is on my github page.

https://github.com/on7dq/Icom-IC-7300-Paddle-Key-Switch

Of course, it's now more than just a paddle/key switch.

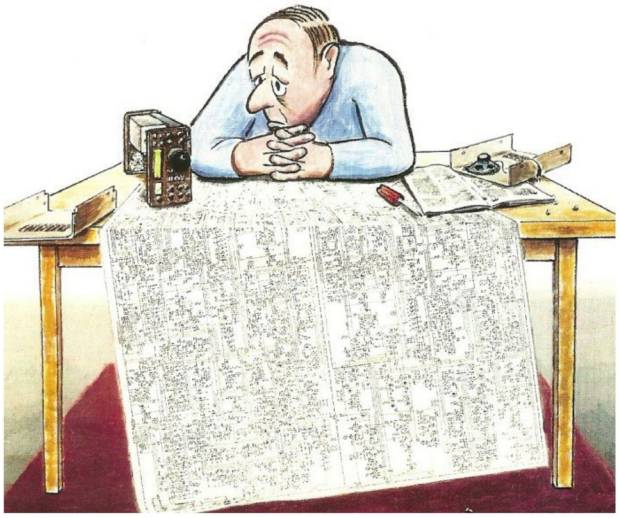
You can easily modify the code to make the buttons do others things as well, you just have to find the correct CI-V commands to send.

At the moment, there is no way to stop the voice messages, so I may modify the code further, maybe make the AF/IF a toggle function with just one button, and use the other button as a STOP switch for the voice memories.

And you can use your own box with 8 buttons , and another Arduino model: UNO, Nano… etc.

Good Luck !

~ Luc ON7DQ / KF0CR



Cartoon by Hans Evers PA0CX

Celebrating the Royal Canadian Air Force 100th Anniversary

Highlights from Canadian Special Event Stations

By JOHN SCHOUTEN VE7TI

April 2024 marked 100 years of service for the Royal Canadian Air Force as a distinct military element. The Centennial milestone placed the RCAF in a unique position to honour its distinct heritage and generate excitement for its future. The RCAF will be showcased in a past, present and future context, with a focus on highlighting contributions to national safety and security, international peace and global stability. The RCAF 2024 Team are curating a year-long program that includes International, National and Regional events, such as the RCAF Run, RCAF Gala, Legends of the Sky, and allied air demonstration team participation in Air Shows across Canada, as well as activities to Inspire future generations of Canadians through STEM initiatives.

A National Amateur Radio Effort Organized by Rick Brown VE3IMG/VA3YV

Rick Brown, VE3IMG/VA3YV, president of the London Amateur Radio Club, spearheaded the initiative to transform this into a national event. The club spent two months contacting various clubs and individuals to turn this into a national event, but this proved to be a daunting task. Finding representation from all Canadian call areas was difficult because the commitment was to operate the entire month of April. Despite the challenges in coordinating across various provinces and territories, many clubs and individuals participated:

- **VE7RCAF**: Surrey Amateur Radio Communications, BC
- **VE6RCAF**: Sask-Alta Radio Club, AB
- **VE5RCAF**: David Candler VE5DLC, and family, SK

- **VE3RCAF**: London Amateur Radio Club, ON
- **VE2RCAF**: Montreal Amateur Radio Club, QC
- **VE9RCAF**: Wayne Tays VE9CWT, NB
- **VE1RCAF**: Lunenburg County Amateur Radio Club, NS
- **VY2RCAF**: Western Prince Edward Island Amateur Radio Club, PE
- **VO1RCAF**: Joseph Earles VO1BQ, and friends, NL

Amateur Radio operators across Canada and well beyond participated in this month-long event and made contacts around the world on all amateur radio bands and modes with the special event RCAF callsigns that were granted to provincial amateur radio groups to commemorate the event.

The London Amateur Radio Club

As the primary organizer, the London Amateur Radio Club, operating from the historic RCAF 427 Wing, played a pivotal role in the RCAF Centennial celebrations with members actively involved in the Royal Canadian Air Force Association and the Secrets of Radar Museum. More details about the club's activities can be found on their website.

Newfoundland and VO1RCAF

Operating from 150 Wing RCAF in St Johns, and with a very modest set up of an iCOM 706MKII and a DXCC dipole supported by a rather short flagpole, organizer Joe Earles VO1BQ and operators Ev Price VO1DK, Rick Turner VO1ZX, plus guest operators participated throughout April.

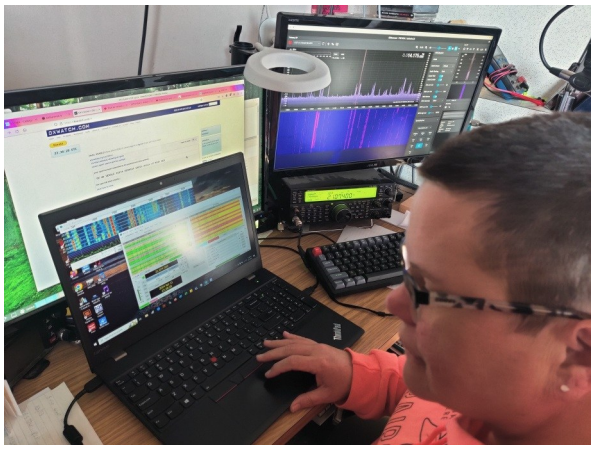
PEI's VY2RCAF Achievements

The VY2RCAF team in Prince Edward Island made substantial contributions to the event, logging 6498 contacts across 105 countries, 6 continents, 35 CQ Zones, and all 50 US states. Despite personal challenges through an unforeseen family emergency, Bob Vary VY2NX, kept in touch with his team, who continued operations. Special thanks go to Dave McDougall VY2FU, Doug Silliker VY2DS, Bill Glydon VY2LI, Lowell Sweet VY2OX, Captain Devin Garlick VY2DFG, and the 327th Royal Canadian Air Cadet Squadron.

Saskatchewan on the air as VE5RCAF

David Candler VE5DLC reported that the Sask-Alta Radio Club, based in Lloydminster, made 1388 contacts during April. The team consisted of Dave operating sideband, Carla Candler VE5YAK on FT8, Dave Funk VE5XL also on sideband, and Ken Millard VE5BI operating CW. They overcame poor band conditions to reach North America, Europe, South America, and even Australia and Japan. Notably, FT8 was particularly effective for DX contacts. Sideband operations were most successful from late afternoon into the evening, with 20M staying open well into late evening, and had VE5RCAF still

David VE5DLC on a POTA activation as VE5RCAF from CA-0623, Saskatchewan Landing Provincial Park



Carla VE5YAK, running FT8 as VE5RCAF from our home station

We got off to a busy start on April 1st, although, like VE5RCAF, some questioned the four letter VE7 call, figuring it was some type of April fool's joke. Later in the month, World Amateur Radio Day was our most successful activation, not surprising give the number of diverse activations celebrating that event. In total, we logged over 1800 contacts using various modes, including seven meteor scatter QSOs by Kevin McQuiggin VE7ZD, satellite contacts by Adrian Mashadi VA7YEP, and even some shortwave listeners who acknowledged our efforts.

reaching states such as Florida and Louisiana well after dark. One other unique challenge was communicating the four-letter suffix of the special event callsign, something US operators are not used to!

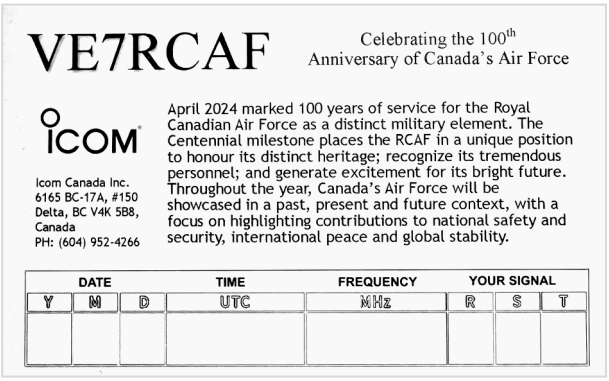
The aspect of this special event most enjoyed was speaking to Canadian and US veterans. Operators would often relate their or their family member's military experience, prompting a 'thank you' for their service and questions about what trade they practised in their respective branch of the armed forces. It was truly an honour to hear their stories.

British Columbia's VE7RCAF Activities

Surrey Amateur Radio Communications (SARC) sponsored VE7RCAF. We created a QRZ page for the call and published background information about the event in both this newsletter, The Communicator, and on our blog. To solicit participation from BC hams we created a Google calendar for April to show available time slots. Fred Orsetti VE7IO agreed to coordinate the reservations and to maintain the aggregated log. SARC Vice-President John Brodie VA7XB maintained the QRZ site and added logs there, and to ARRL Logbook of the World.

[Right] WW2 transmitter model BC-458-A has been modified to shift frequency coverage up into the 40m band.

[Below] VE7CNF with both the vintage transmitter and modern receiver in the right background and homebrew T/R relay unit in the left foreground.


VE7RCAF

Celebrating the 100th Anniversary of Canada's Air Force

ICOM

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6165 BC-17A, #150
Delta, BC V4K 5B8,
Canada
PH: (604) 952-4266

April 2024 marked 100 years of service for the Royal Canadian Air Force as a distinct military element. The Centennial milestone places the RCAF in a unique position to honour its distinct heritage; recognize its tremendous personnel; and generate excitement for its bright future. Throughout the year, Canada's Air Force will be showcased in a past, present and future context, with a focus on highlighting contributions to national safety and security, international peace and global stability.

DATE			TIME	FREQUENCY	YOUR SIGNAL		
Y	M	D	UTC	MHz	R	S	T

Dmitry Sevostiyanov VA7DVO's POTA activation on April 6th, logged 84 contacts using 60 Watts on sideband, including a DX connection to Japan. Dmitry's activation was captured in a short video here.

The Orca DXCC Club

Members of the Orca DXCC club, Mark Mattila VA7MM, and Toby Haynes VE7CNF, operated WW2 Command Set 50-Watt transmitters as VE7RCAF. They completed three planned sessions, logging CW contacts on Easter Monday, Vimy Ridge Day, and World Amateur Radio Day, adding historical ambiance with their vintage equipment.

QSL Cards and Acknowledgements

As events wind down, handling QSL cards from around the world becomes the focus. Each participating RCAF station made their own arrangements for QSL cards, and here in BC, iCOM was the corporate sponsor.

Special recognition goes to all the individuals who participated, and we thank the entire RCAF station network across Canada for their exceptional work and contributions, making the event both successful and memorable.

~ John VE7TI

Goal: A 10 GHz Beacon in Surrey

by JOHN BRODIE VA7XB

On June 19, 2024 Dino VE7NX and Scott VA7SC made the first 10 GHz SSB QSO using recently constructed gear. I asked Dino to provide some details of the device he has been working on for several months. Here is what I learned.

What we call the 10 GHz band is also known as the X-band or the 3 cm band. It is used for moon bounce, mountain top bouncing and rain scatter on SSB, CW or FM. At this frequency, a dish or horn antenna and waveguide are used instead of the yagis and coaxial cable which are conventional for HF. The received signal from the dish antenna is passed to a transverter which converts the signal to a lower frequency, in this case 2m. Conversely when transmitting, the signal is converted from 2m up to 10 GHz.

By the time you read this you will be aware that Dino's device was deployed at Field Day 2024 to make a 10 GHz demonstration contact across the parking lot between VE7SAR and VA7SC.

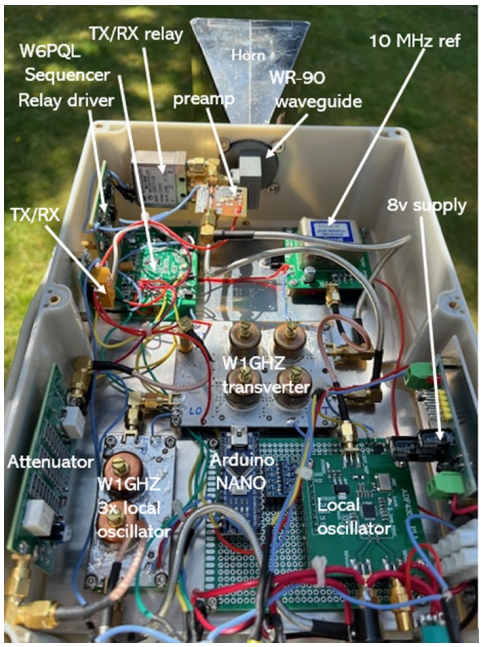

Scott VA7SC's setup

The immediate plan is to set up the first 10 GHz beacon west of Ontario with the help of Scott VA7SC who will initially install it at his home. Later, the beacon will be relocated to SARC's repeater site on the roof of Concord tower, a 36-story high rise in Central Surrey. However, other sites will be considered because the Concord location is increasingly being surrounded by high rises which obstruct the line of sight in most compass directions.

Dino's homebrew 10 Ghz box has power output of +5dbm (3.1 mW) with effective radiated power of 100 mW. It consists of:


Dino VE7NX's setup

- W1GHZ 10 GHz transverter board
- W1GHZ 10 GHz tripler board
- Local oscillator: Analog Devices ADF4351 chip at 3,408 GHz
- Local oscillator driven by Arduino Nano
- 10 MHZ reference for the local oscillator
- W6PQL Sequencer
- 30 dB attenuator with auto switching
- 28 GHz RX/ TX latching relay with W6PQL driver board
- 8V DC supply
- Yaesu FT818ND as IF radio on 2m
- Antenna: horn with 18 dBi gain
- 12v 10 amp smart battery
- Manfrotto camera X,Y, Z manual control
- Bosch tripod



Hats off to Dino for conceiving and assembling this cutting-edge project! 10 GHz will be a good technical topic for the project group in the Fall to gain an understanding of the concepts and construction techniques and how it can be used.

~ John VA7XB

TECH TOPICS

MESH: If a node is out of direct range of the destination, intermediate nodes will relay the message

by JOHN SCHOUTEN VE7TI

Meshtastic is an innovative open-source project designed to create long-range, low-power mesh networks. Utilizing LoRa (Long Range) technology, Meshtastic enables communication over significant distances without relying on cellular networks or Wi-Fi. This makes it ideal for outdoor enthusiasts, emergency communication, and anyone needing to maintain contact in areas with limited connectivity. Amateur Radio has embraced Meshtastic because of its unique communications capabilities, including reliability and range.

A Meshtastic network uses LoRa radio modules to form a mesh network. In a mesh network, each device, or node, communicates with nearby nodes, which in turn relay messages across the network. This multi-hop communication extends the effective range of the network beyond the capabilities of a single device. Key features of Meshtastic networks include long-range communication, low power consumption, decentralized operation, and encrypted communication, ensuring that messages remain private and secure.

What is LoRa and How Does it Pass Messages?

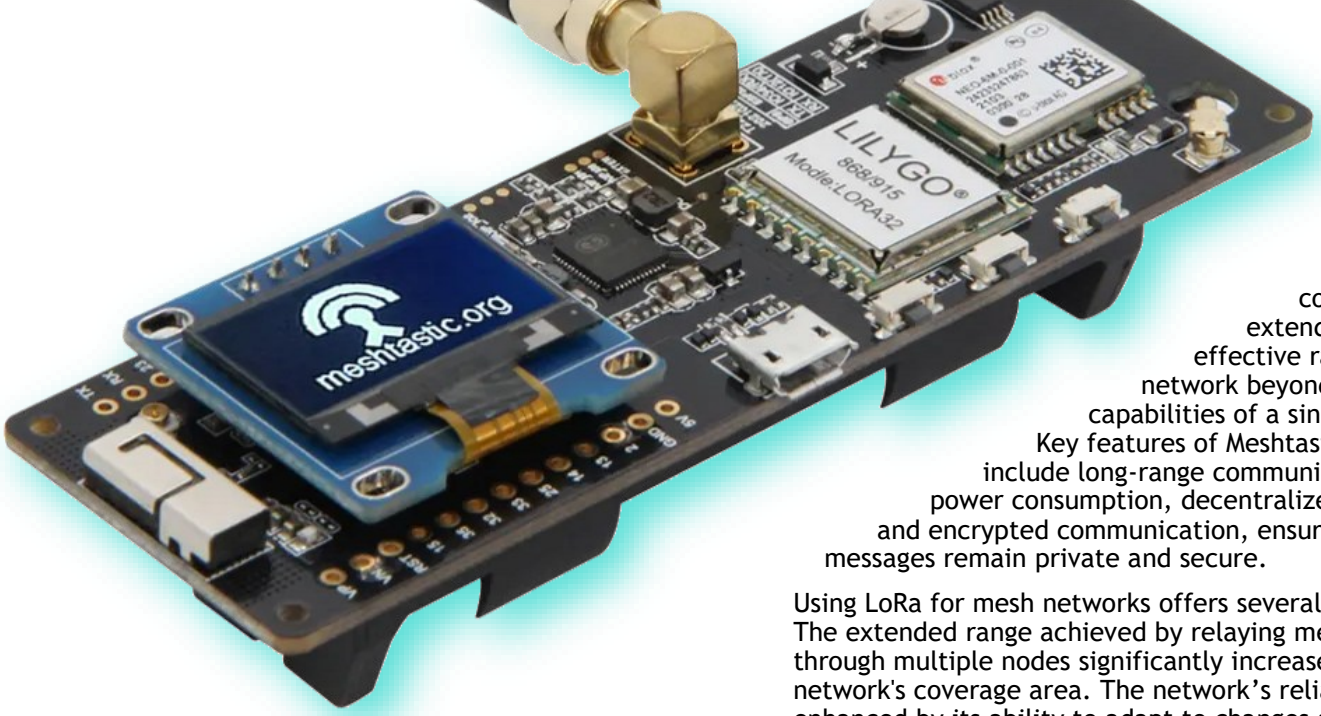
LoRa Technology Overview

LoRa, which stands for Long Range, is a wireless communication technology developed by Semtech Corporation. It is specifically designed to transmit data over long distances while consuming minimal power, making it ideal for Internet of Things (IoT) applications. Operating in sub-gigahertz frequency bands like 433 MHz, 868 MHz, and 915 MHz, LoRa provides better penetration through obstacles compared to higher frequency bands, resulting in robust and reliable communication even in challenging environments.

LoRa's key features include its long-range capability, allowing data transmission over several kilometres in rural areas and up to a few kilometres in urban environments. Its low power consumption enables devices using LoRa to operate on batteries for several years, thanks to its energy-efficient design. While LoRa supports low data rates, it is optimized for small data packets. Additionally, LoRa’s modulation technique offers high resilience against interference and multipath fading, ensuring reliable communication.

How LoRa Passes Messages

Mesh networking is a method where multiple devices, known as nodes, communicate with each other to form a network that allows data to be relayed from one node to another. This creates a flexible and robust network structure that can cover large areas without requiring all nodes to be in direct communication with a central hub.



In a typical LoRa network, a star topology is used where all nodes communicate directly with a central gateway. However, LoRa can also be used in mesh networks, where nodes forward messages from one to another, thereby extending the range and reliability of the network. This mesh capability is particularly useful in applications like Meshtastic, an open-source project that leverages LoRa technology to create long-range communication networks.

In a LoRa mesh network, each node has a LoRa module for sending and receiving messages. Nodes within range communicate directly, while nodes out of direct range rely on intermediate nodes to relay messages. This multi-hop communication method enables the network to cover a much larger area than a single LoRa transmitter could achieve alone. The mesh network is also self-healing, meaning it can dynamically reroute messages through other nodes if one fails or moves out of range, ensuring continuous communication.

Technically, nodes broadcast messages using LoRa modulation, which includes the message data, source address, destination address, and other metadata. All nodes in the network constantly listen for incoming messages. Upon receiving a message, a node checks if it is the intended recipient. If it is not, the node forwards the message to other nodes, following predefined routing protocols to avoid loops and ensure efficient delivery. Nodes can also send acknowledgments back to the sender to confirm receipt and enhance reliability.

Benefits of Using LoRa for Mesh Networks

A Meshtastic network uses LoRa radio modules to form a mesh network. In a mesh network, each device, or node, communicates with nearby nodes, which in turn relay messages across the network. This multi-hop communication extends the effective range of the network beyond the capabilities of a single device. Key features of Meshtastic networks include long-range communication, low power consumption, decentralized operation, and encrypted communication, ensuring that messages remain private and secure.

Using LoRa for mesh networks offers several benefits. The extended range achieved by relaying messages through multiple nodes significantly increases the network's coverage area. The network's reliability is enhanced by its ability to adapt to changes and reroute messages as needed, making it robust against node failures. Furthermore, the network is highly scalable; new nodes can be added easily, expanding its coverage and capacity.

LoRa and mesh networking provide a powerful combination for creating resilient, long-range communication networks. Projects like Meshtastic showcase the practical applications of this technology, offering a valuable tool for anyone needing reliable communication in remote or infrastructure-poor areas.

The Hardware

One affordable device is the LilyGO T-Beam, popular for building Meshtastic nodes with its integrated LoRa module, GPS, networking and battery management features. It is the device that we have adopted for our club experimentation.

To get started with a LilyGO T-Beam, you will need the device itself, an appropriate antenna for the frequency band you plan to use, a lithium-ion battery to power your T-Beam, a USB cable for programming and charging, and the Meshtastic firmware downloadable from the Meshtastic GitHub repository.

Device characteristics and what to avoid:

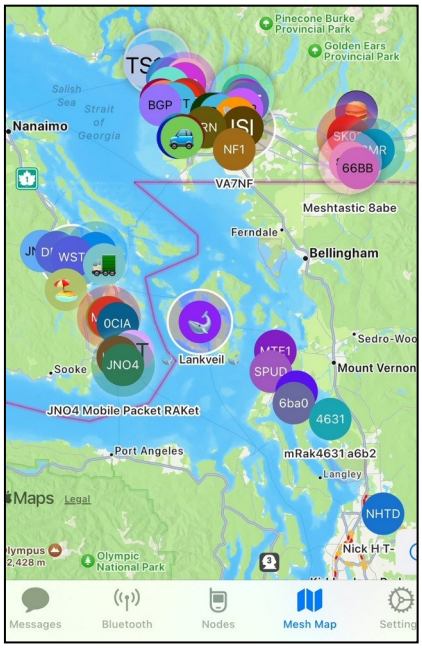
- ESP-32
- 902-928 mHz in US and Canada
- Look for SX1262 (and optionally the supreme version)
- The best GPS performance is with a U-blox chip but an L76K chip is also all right, although it will have a slightly longer acquisition time and less accuracy.

It is recommended to avoid LilyGo versions 0.7 through 1.1

First, install the necessary software by downloading and installing the Arduino IDE or PlatformIO. These environments will allow you to upload the Meshtastic firmware to your T-Beam. Install the required libraries and dependencies as outlined in the Meshtastic documentation. Next, download the Meshtastic firmware from the official GitHub repository and open it in your chosen development environment. Adjust the configuration settings in the firmware to match your specific hardware and regional frequency requirements, and then connect your T-Beam to your computer using the USB cable. Compile and upload the firmware to your T-Beam using your development environment.

Once the firmware is running, download and install the Meshtastic app on your smartphone from the Google Play Store or the Apple App Store. Pair your smartphone with the T-Beam via Bluetooth. Insert the battery into the T-Beam and ensure it is charged. Alternatively, you can power the T-Beam via USB.

After your T-Beam is set up, you can start communicating with other Meshtastic nodes. You can send and receive text messages over the mesh network, share your GPS location with other nodes, and monitor the status of other nodes, including battery level and signal strength.



Nodes seen on my iPhone from home in Surrey, BC

How LoRa is Used by Amateur Radio Operators

LoRa (Long Range) technology, originally developed for Internet of Things (IoT) applications, has found a niche among amateur radio operators due to its long-range, low-power communication capabilities. Amateur radio enthusiasts leverage LoRa for various projects, including telemetry, remote sensing, and even experimental communication networks at higher legal power levels than non-hams. Here's how LoRa is typically utilized in the amateur radio community:

Mesh Networks: Some amateur radio operators experiment with LoRa-based mesh networks to create ad-hoc communication systems. This involves setting up multiple LoRa nodes that can relay messages between them, extending the coverage area beyond the reach of a single LoRa transmitter.

Emergency Communication: In emergency scenarios, LoRa can provide a reliable means of communication when other systems are down. Amateur radio operators can set up LoRa gateways and devices to facilitate the transmission of critical information over long distances.

For greatest accuracy, the U-blox GPS module is recommended

Amateur Satellites: LoRa technology is also being explored for use in amateur radio satellites (CubeSats). The low power consumption and robust signal integrity make it suitable for spaceborne applications, where efficient use of limited power resources is crucial.

Telemetry and Remote Sensing: LoRa modules are often used in telemetry systems to transmit data from remote sensors. This can include environmental monitoring (temperature, humidity, atmospheric pressure) or tracking the position of high-altitude balloons and drones. The long-range capability allows data to be sent over several kilometers without the need for repeaters.

Frequencies in Use Worldwide

LoRa operates in different frequency bands depending on the region, as it needs to comply with local regulations. Here are the common frequency bands used for LoRa communications around the world:

Canada and the United States:

- 915 MHz (US915)

Europe:

- 868 MHz (EU868)
- 433 MHz (EU433, though less common)

(Continued on page 53)

How LoRa Messages Propagate Long Distances

LoRa technology enables the transmission of messages over long distances by employing a combination of modulation techniques, low frequency bands, and advanced signal processing. Here's a detailed explanation of how LoRa achieves long-distance communication.

Chirp Spread Spectrum (CSS) Modulation: LoRa uses a modulation technique called Chirp Spread Spectrum (CSS). CSS works by spreading the signal over a wider bandwidth than the original data signal. Each bit of data is represented by a chirp, which is a signal that increases or decreases in frequency over time. This spreading of the signal makes it more resistant to interference and allows it to be detected at very low signal-to-noise ratios (SNR), enhancing its range.

Low Frequency Bands LoRa operates in sub-gigahertz frequency bands, typically around 433 MHz, 868 MHz, and 915 MHz. Lower frequency signals generally propagate better over long distances and have superior penetration capabilities through obstacles such as buildings and trees. This characteristic contributes to LoRa's ability to communicate over extensive areas.

High Link Budget The link budget is a measure of the total power loss from the transmitter to the receiver, accounting for all gains and losses. LoRa's high link budget, often exceeding 150 dB, allows it to maintain communication links over long distances. This high link budget is achieved through a combination of low-power operation and high sensitivity of LoRa receivers.

Adaptive Data Rate (ADR) LoRa networks use an Adaptive Data Rate (ADR) scheme to optimize data rates, transmission power, and airtime. By adjusting these parameters based on the current link conditions, ADR ensures that each node in the network communicates at the optimal settings, extending battery life and maximizing range.

Forward Error Correction (FEC) LoRa incorporates forward error correction (FEC) to improve the reliability of data transmission. FEC adds redundancy to the transmitted information, allowing the receiver to detect and correct errors without needing a retransmission. This capability is particularly beneficial in environments with high interference, ensuring data integrity over long distances.

Low Data Rates LoRa is designed for low data rate applications, which means it transmits small amounts of data over extended periods. The lower the data rate, the longer the range, because the receiver has more time to detect and process the signal. This characteristic makes LoRa suitable for applications where infrequent, small data transmissions are sufficient, such as sensor networks.

Network Topologies LoRa networks can use various topologies to enhance range. In a star topology, nodes communicate directly with a central gateway. In a mesh topology, messages can hop from node to node, extending the overall coverage area. Mesh networks are particularly effective in environments where direct communication with the gateway is not possible due to obstacles or long distances.

Robustness Against Interference LoRa's CSS modulation is highly robust against interference. The spreading factor (SF) in CSS can be adjusted, with higher spreading factors allowing longer ranges but lower data rates. This adaptability ensures that LoRa can maintain communication even in noisy environments.

Penetration Capability The ability of LoRa signals to penetrate through buildings and other obstacles is a significant factor in their long-distance propagation. This penetration capability is attributed to the lower frequency bands used by LoRa, which suffer less attenuation through materials compared to higher frequency signals.

Use of Gateways LoRaWAN, the network protocol on top of LoRa, uses gateways to relay messages between end devices and the central network server### Introduction to Meshtastic Networks and Getting on the Air with a LilyGO T-Beam.

Asia:

- 433 MHz (Asia regions, including China)
- 920-923 MHz (Japan)

Australia:

- 915-928 MHz (AU915)

India:

- 865-867 MHz (IN865)

South America:

- 902-928 MHz
  (typically aligned with US 915)

The specific frequencies used can vary slightly based on national regulations and available spectrum in each country. For amateur radio operators, it's essential to ensure that their use of LoRa complies with local frequency allocation and licensing requirements.

Regulatory Considerations

While LoRa itself is not restricted to amateur radio bands, operators must still adhere to the regulatory requirements for unlicensed frequency bands. In some regions, using LoRa on amateur radio bands might require specific licensing or adherence to particular transmission power limits and duty cycles to avoid interference with other services.

A great general overview video of both Meshtastic and APRS messaging is at: Meshtastic Problems - And Another Off Grid Messaging System - YouTube

Check out the YouTube beginner's videos at:

A Non-Technical Introduction to Meshtastic Off-Grid Radio Communications (youtube.com)

Getting Started with Meshtastic - Devices - YouTube

*Get Started In **Meshtastic FAST**! (youtube.com)*

A bit more technical:

Advanced Meshtastic - Radio Configuration Part 1 - YouTube

Advanced Meshtastic - Radio Configuration Part 1 - YouTube

Metal 3D Printing on the Markforged Metal X v2 (youtube.com)

~ John VE7TI

Heltec v3

Heltec from Amazon

Channel setting	Alt Channel	Data-Rate	SF /	Coding	Band-
Short Range / Fast	Short Fast	10.94 kbps	7 / 128	4/5	250
Short Range / Slow	Short Slow	6.25 kbps	8 / 256	4/5	250
Medium Range / Fast	Medium Fast	3.52 kbps	9 / 512	4/5	250
Medium Range / Slow	Medium Slow	1.95 kbps	10 / 1024	4/5	250
Long Range / Fast	Long Fast	1.07 kbps	11 / 2048	4/5	250
Long Range / Moderate	Long Moderate	0.34 kbps	11 / 2048	4/8	125
Long Range / Slow	Long Slow	0.18 kbps	12 / 4096	4/8	125
Very Long Range / Slow	Very Long Slow	0.09 kbps	12 / 4096	4/8	62.5

Gnuradio Supports LoRa TX and RX

By Kevin McQuiggin VE7ZD/KN7Q

The popular open-source SDR (Software-Defined Radio) package gnuradio (https://gnuradio.org) now supports the low power communication technology LoRa "out of the box".

Gnuradio-companion (gnuradio's graphical user interface or GUI) now includes blocks for LoRA reception and transmission that allow them to be easily connected to popular SDR receivers and transmitters including RTL-SDR dongles and transceivers such as the HackRF, BladeRF, and products from Ettus Research.

The blocks (shown in Figure 1) have simple input and output connections that will allow them to be connected to other signal chain components with relative ease.

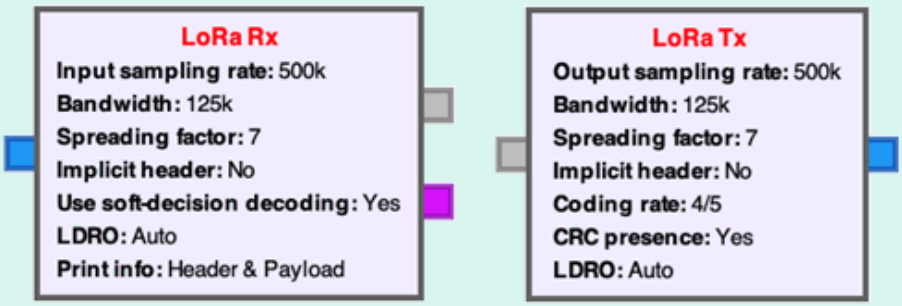


Figure 1 – LoRa TX and RX Hierarchical Blocks

Internally, both LoRa blocks are "hierarchical blocks" – this means that they include complex functionality and encapsulate several other low-level DSP blocks internally.

A hierarchical block allows this complexity to be presented to the gnuradio user as a single block with simple input and output points.

Each of the LoRa blocks include enough documentation to allow a new gnuradio user to understand the input and output ports and integrate LoRa into their own projects. Figure 2 shows the documentation for the LoRa RX block. Fuller documentation is available on the gnuradio website.

Figure 2 – LoRa Receive Block Documentation

Complete LoRa receiver
Hierarchical block containing a complete LoRa receiver.

Parameters:
- Input sampling rate: Input sampling rate (Should be an integer multiple of Bandwidth)
- Bandwidth: bandwidth of the LoRa signal
- Spreading factor
- Implicit header: Use implicit header mode, else use explicit
- Coding rate: coding rate to use (only for implicit mode)
- CRC presence: Payload contains a CRC (only for implicit mode)
- Payload length: Length of the payload in bytes (only for implicit mode)
- Use soft-decision decoding: Use soft-decision decoding
- Print info: Print received payload/header in the terminal

Inputs:
- in: Stream of complex samples

Outputs
- (optional) out(msg): Message containing the received payload
- (optional) out(bytes): Received payload as a stream of char (bytes), with tagged with payload length and CRC verification result.

It would be relatively easy to use this block with a standard RTL-SDR dongle to experiment with LoRa reception around your home.

~ Kevin VE7ZD/KN7Q

Observed Solar Eclipse Effect

on HF Radio Propagation

by MARK MATTILA VA7MM

On April 8, 2024, a total solar eclipse crossed North America from Mexico in the southwest to the Canadian Maritimes in the northeast, ***Figure 1***. Many amateur radio enthusiasts followed the eclipse by joining the Solar Eclipse QSO Party sponsored by Ham Radio Science Citizen Investigation (HamSCI).

The author, located on south coastal British Columbia at 2903 km from the path of totality, investigated the eclipse using WSPR (Weak Signal Propagation Reporter) signal strength across the path of totality as the eclipse shadow passed between transmitting and receiving stations. For the analysis, station TI4JWC (transmitting) in Costa Rica was selected, as the station is on the opposite side of the path of totality from VA7MM in British Columbia (receiving), ***Figure 2***. There was no coordination with TI4JWC for this investigation, rather the station was observed to routinely transmit WSPR with a high frequency on the 10m and 15m bands. The path of totality crossed between the stations in the state of Texas, ***Figure 2***. WSPR station and path information are presented in ***Table 1***.

The time of interest is when the eclipse umbra, the totality shadow region, passes over the great circle line between the transmitting and receiving stations. NASA data obtained from URL https://eclipse.gsfc.nasa.gov/ was used to determine that the eclipse umbra would cross the signal path at 18:35:30 UTC. This would be the approximate time to look for effects on HF propagation. A great circle

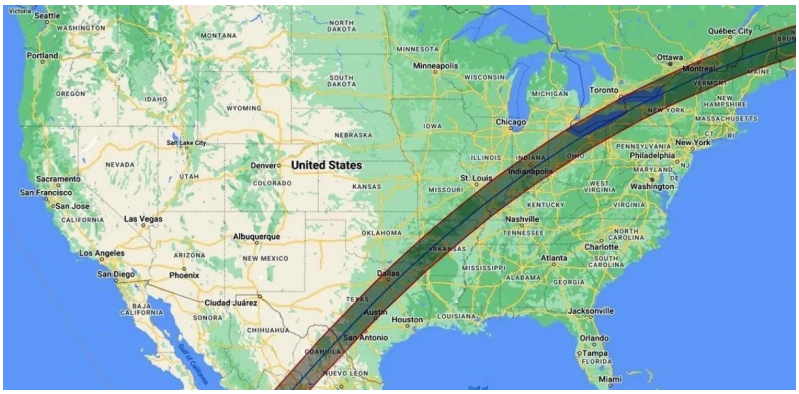


Figure 1: *Path of totality across the United States of the solar eclipse of April 8, 2024.*

Table 1: WSPR Station and Path Information

Description	TI4JWC	VA7MM
Solar Flux Index April 8, 2024	125 (Penticton: λ = 10.7cm)	
Maidenhead Grid	EK70wb	CN89og
Geographic Coordinate	10° 2.747'N, 84° 9.754'W	49° 17.397'N, 122° 45.671'W
Station - Station Path Distance	5626 km	
Totality - Great Circle Intersection	30° 25.477'N, 98° 50.645'W, Central Texas	
Station to Totality Path Distance	2723 km	2903 km
Station to Totality Path Ratio	48%	52%
Equal Double Hop Skip Distance	2813 km	
Transmitter	1 watt	Receive Only
Receiver	Transmit Only	Yaesu FT-817

Figure 2: *TI4JWC to VA7MM great circle line and eclipse totality intersect in Texas at 18:35:30 UTC. Imagery: Google Earth, 2024.*

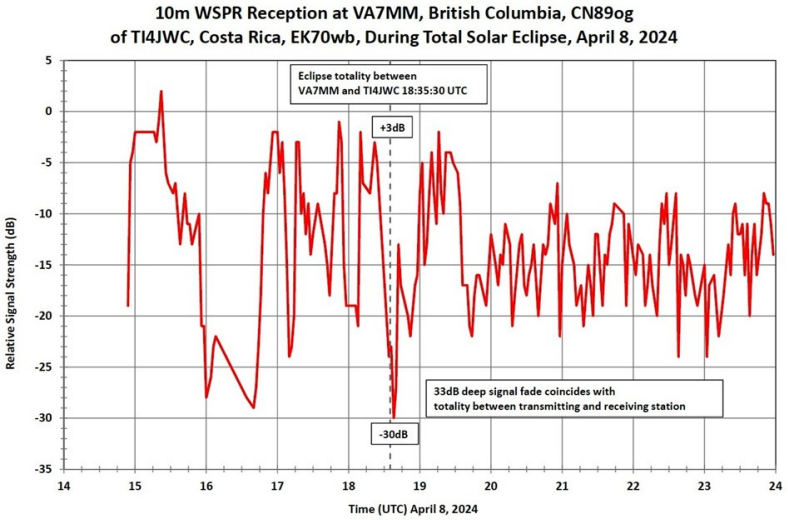


Figure 3: *WSPR on 10m showed a signal fade of about 33db as the umbra passed the great circle line.*

signal path is a simplifying assumption as signals may deviate from this path under certain conditions. As maximum skip distance for ionosphere F2 layer propagation is generally reported as 4,000 km, the 5,626 km signal path between the stations is thought to be either double or triple hop skip. Using the WSPR database, signals received at VA7MM from TI4JWC were plotted as SNR (signal to noise ratio) versus time for the 10m band, **Figure 3**, and the 15m band, **Figure 4**.

On the 10m band, a drop of over 25dB in received signal occurred coincidentally with the umbra crossing the great circle line between the transmitting and receiving station, **Figure 3**. This is deemed to be from the MUF dropping in response to the drop of incident solar flux, and ionosphere electron density, in the region of the ionosphere blacked out by the passing umbra region.

On the 15m band, a peak in signal strength of almost 20dB occurred coincidentally with the umbra crossing the great circle line between the transmitting and receiving stations, **Figure 4**. This is deemed to be from the MUF dropping to the 15m frequency range where the signal path was enhanced by more favorable refraction through the ionosphere.

From the SNR time history, signal changes of interest are summarized in **Table 2**.

The assumption that the signal propagates along the great circle line is a starting point for analysis. The 15m SNR history shows two signal peaks after the umbra crossed the great circle line, **Figure 4**. The time difference between the 15m peak and the umbra crossing of the great circle line at 18:35:30 UTC indicates either signal propagation on a skewed path aligned with the down range location of the umbra, or an ionosphere response time to the umbra passage. The double

Table 2: Signal Changes Coincident with Passage of Eclispe Umbra Over the Great Circle Line

Band (m)	Signal Change	Start (UTC)	End (UTC)	Duration (minutes)	Rate of Change (dB/ minute)
10	33dB Fade	18:22	18:38	16	2.1
15	19dB Peak	18:34	18:42	8	2.4

signal peak on 15m, **Figure 4**, is indicative of an MUF drop following the first peak followed by a recovery with the second peak. After that the band settles down to the pre-eclipse condition. However, what exactly is going on with the 15m time difference between the peaks and the great circle line is uncertain, and seemingly unsolvable, with WSPR SNR data.

Double versus Triple Hop

If it is assumed the double hop skip distances are equal along the path between transmitting and receiving stations, the Earth reflection point would be in the region of central Texas with the ground reflection center about 90 km off the path of totality. This leads to the question – if the earth reflection point is so close to the path of totality, then why is there a significant peak in 15m signal strength if at that point the signal is at the Earth's surface as opposed to the ionosphere?

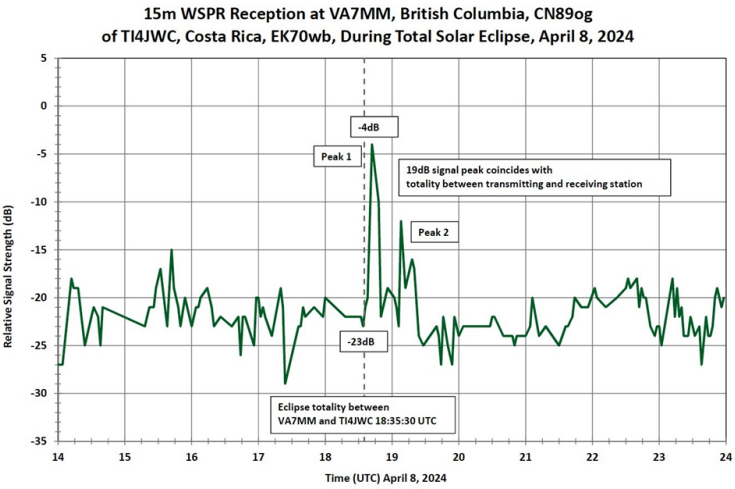
This suggests the signal is taking a path other than double hop skip. To check the case for double hop skip, WSPR data for stations in Texas, KG5RMJ (receiving TI4JWC) and N5ATH (transmitting to VA7MM), were reviewed, **Figures 5 and 6**. Station KG5RMJ is on the first hop of a double hop path and station N5ATH is on the second hop of a double path, **Figure 2**.

In the case of KG5RMJ receiving TI4JWC, the station range is 2,861 km and a 15m SNR response to the passage of the eclipse between the stations is not obvious, **Figure 5**.

In the case of VA7MM receiving N5ATH at a range of 3,091 km, **Figure 6**, a 15m signal peak in response to the passage of the eclipse is not present in the data. Rather, a signal fade is present contrary to the 15m signal peak observed in the TI4JWC to VA7MM signal path, indicating double hop skip is unlikely.

In the case of triple hop skip from TI4JWC to VA7MM the second point of ionosphere refraction, R2, lies on the path of totality, **Figure 7**. It is known that a solar eclipse umbra moving over the ionosphere will cause a temporary drop in ionization, or electron density, following the decrease in solar radiation

***Figure 4**: WSPR on 15m showed a signal peak of about 19db after the umbra passed the great circle line.*



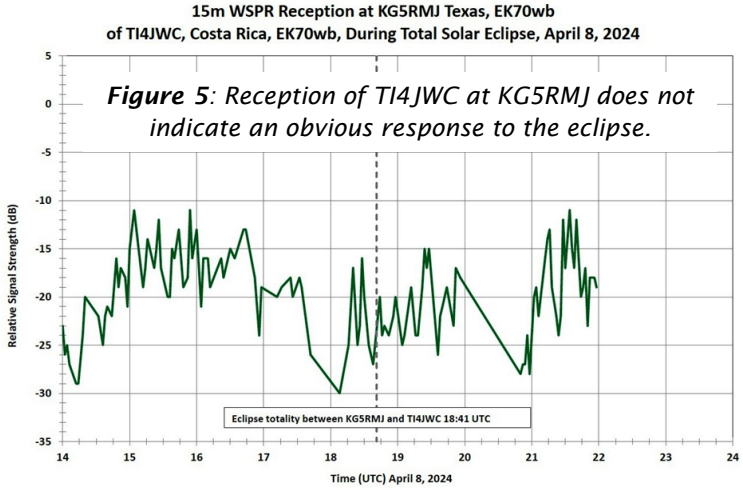


***Figure 5**: Reception of TI4JWC at KG5RMJ does not indicate an obvious response to the eclipse.*

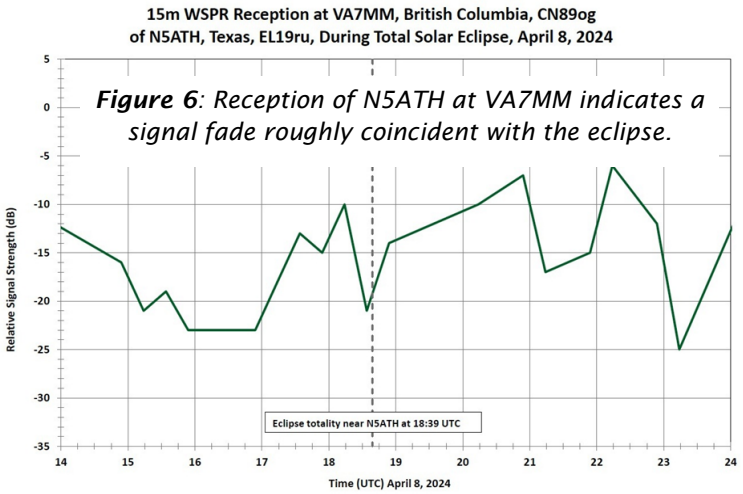
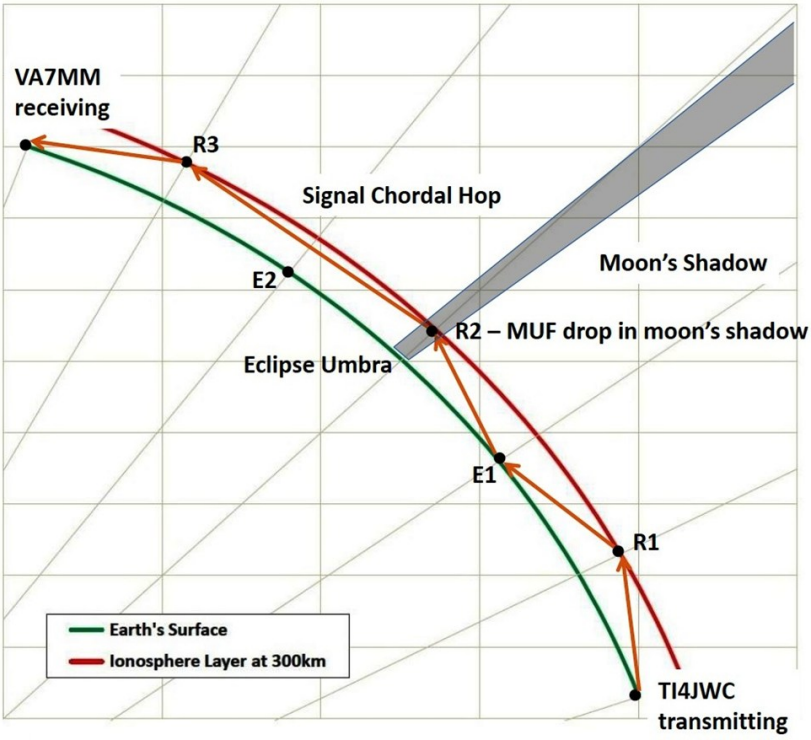


***Figure 6**: Reception of N5ATH at VA7MM indicates a signal fade roughly coincident with the eclipse.*

with a recovery after the shadow passes. During this brief period the ionosphere will take on nighttime characteristics with the drop in MUF and increased refraction angles. An increase in refraction angle equates to a radio band 'going long' which can be observed daily on certain HF radio bands with the transition from day- to night-time propagation.

Chordal Hop

A plausible explanation for the observed signal peak on 15m from TI4JWC to VA7MM is a chordal hop directly from ionosphere refraction point R2 to point R3, **Figure 7**. With the decreased electron density, the refractive index increased to the point that the signal propagated from point R2 to R3 where higher ionization was encountered enabling refraction back down to Earth. During totality, the brief formation of a chordal hop avoided Earth reflection point E2 which decreased path loss enabling the 20dB signal peak observed on 15m, **Figure 4**.



Conclusions

Conclusions from this elementary propagation analysis include:

- Solar eclipse effect on 10m and 15m band propagation was observable between stations transmitting and receiving WSPR on opposite sides of the path of totality, TI4JWC and VA7MM, respectively.
- The observed effect on propagation was obvious about the time the eclipse umbra region crossed the great circle line between transmitting and receiving stations.
- The deep fading on 10m and signal peak on 15m indicates an MUF drop along the path between the transmitting and receiving stations.
- Signals on each leg of the double hop signal path indicate that this mode was not likely; rather, triple hop skip was present before and after the passage of the eclipse umbra between the stations.
- The observed 20dB signal peak on 15m during totality between the stations can be explained by a chordal hop from the second point of ionosphere refraction to the third point which avoids a ground reflection.
- The observed solar eclipse effects in WSPR data were transient with the band recovering after about an hour.
- The entire region between the transmitting station and the receiving station was under the eclipse penumbra but an effect from the penumbra region on signal propagation was not apparent.

***Figure 7**: Alteration of TI4JWC to VA7MM signal path to chordal hop during passage of solar eclipse*

- The refractive layer of the ionosphere is not static and likely moving in height and angle which would be a factor in propagation that is not resolvable from WSPR SNR data.

This elementary investigation uses only WSPR SNR time history to assess the effect of the eclipse on propagation, so the findings and conclusions are limited by this proxy data. More sophisticated methods of measurement and analysis would be required to delve further.

Credit is given to the developers of WSPR and WSJT-X for delivering an informative analytical system enabling the amateur radio community to assess and evaluate radio propagation on which their hobby and enterprise relies.

~ Mark Mattila VA7MM

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Amateur Radio Experience with the Extreme Solar Storm of May 10, 2024

by MARK MATTILA VA7MM

On May 8, 2024, a powerful solar storm produced five solar flares, from which three closely spaced coronal mass ejections (CMEs) hit the Earth around midday on Friday May 10, 2024. A large, magnetically complex and immense sunspot cluster, NOAA region 3664, approximately 16 Earth diameters across in size, produced all the flares. An extreme class G5 geomagnetic storm, the most intense category of disturbance to the Earth's magnetic field, followed and persisted until Sunday, May 12, 2024. It was the largest geomagnetic storm since October 2003 with the series of CMEs enabling storm persistence for over a day. Magnetic field disturbance – storm time (Dst) index is used to quantify geomagnetic storm scale, with negative index numbers indicating a weakening of the magnetic field. The geomagnetic storm of May 10, 2024 was among the top five of the most severe storms recorded, **Table 1**.

The planetary index K index, Kp, is the mean standardized K index derived from thirteen global geomagnetic observatories. The Kp index, which indicates geomagnetic effects of solar particle radiation, attained the highest possible rating of 9 during the storm, **Figure 1** *[next page]*.

Solar flares are classified by peak X-ray flux; currently, this is measured by the GOES 16 geosynchronous satellite. The

Table 1: Record Extreme Geomagnetic Storm Ranking

Date	Dst Index (nT)	Remarks
September 1859	-800 to -1750 estimated	Solar Cycle 10, Carrington Event
May 1921	-907	Solar Cycle 15
March 1989	-589	Solar Cycle 22
October 2003	-422	Solar Cycle 23, Class G5 Storm
May 2024	-412	Solar Cycle 25, K index 9, Class G5 Storm

Source: https://en.wikipedia.org/wiki/May_2024_solar_storms and article links

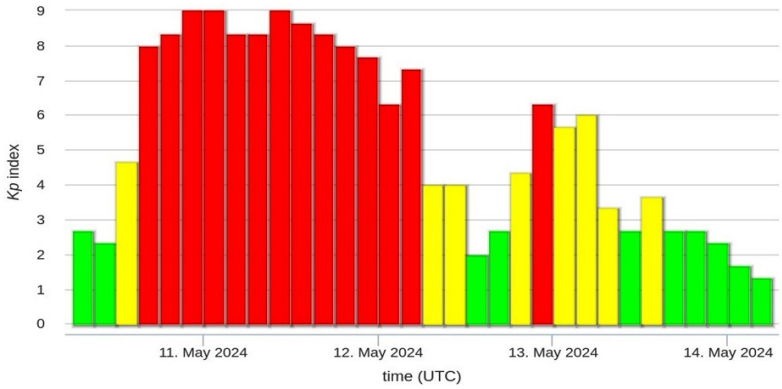


***Figure 1**: Planetary K index during the extreme geomagnetic storm of May 10, 2024. Source: GFZ German Research Centre for Geosciences.*

Table 2: Ranking of Top Ten Recorded Solar Flares

Ranking	Date	X-Ray Flux Class	Remarks
1	4-Nov-2003	X28.0+	Solar Cycle 23, G5 Geomagnetic Storm
2	2-Apr-2001	X20.0	Solar Cycle 23
3	16-Aug-1989	X20.0	Solar Cycle 22
4	28-Oct-2003	X17.2	Solar Cycle 23, G5 Geomagnetic Storm
5	7-Sep-2005	X17.0	Solar Cycle 23
6	6-Mar-1989	X15.0	Solar Cycle 22
7	11-Jul-1978	X15.0	Solar Cycle 21
8	15-Apr-2001	X14.4	Solar Cycle 23
9	24-Apr-1984	X13.0	Solar Cycle 21
10	19-Oct-1989	X13.0	Solar Cycle 22

Source: https://www.spaceweather.com/solarflares/topflares.html

Table 3: Example Auroral Scatter 144 MHz CW Communication, 11-May-2024 UTC

Index	Station	Time (UTC)	Band (MHz)	Worked	QTH	Grid	Report Sent	Distance (km)
6	VE7SL	0045	144	KG7CW	ID	DN14	57A	717
7	VE7SL	0045	144	W6GY	ID	DN13	59A	780
8	VE7SL	0045	144	KC7DX	OR	CN85	59A	331
9	VE7SL	0045	144	W7JMP	OR	CN85	55A	370
10	VE7SL	0045	144	VE7CV	BC	CO80	57A	292
14	VA7MM	0500	144	VE7PS	BC	CN09	55A	313
							Average Distance (km):	498

Table 4: Example Auroral Scatter 50 MHz CW Communication, 11-May-2024 UTC

Index	Station	Time (UTC)	Band (MHz)	Worked	QTH	Grid	Report Sent	Distance (km)
1	VE7SL	0030	50	K7TM	ID	DN17	59A	500
2	VE7SL	0030	50	VE6TA	AB	D033	57A	874
3	VE7SL	0030	50	KD7QT	WA	CN86	59A	209
4	VE7SL	0030	50	KF7PCL	WA	CN76	59A	222
5	VE7SL	0030	50	N7CNH	OR	CN84	57A	530
6	VE7SL	0400	50	WB8VLC	OR	CN84	57A	438
7	VE7SL	0400	50	VE7BV	BC	CO90	59A	300
8	VE7SL	0400	50	VA7XU	BC	CO82	55A	459
9	VA7MM	0540	50	WB7AKE	WA	CN86	44A	300
10	VA7MM	0540	50	K7JX	WA	CN87	55A	224
							Average Distance (km):	406

geomagnetic storm of May 10th was the strongest in twenty years, however, the solar flares that produced it on May 8th only attained X-ray flux class X1.0. Sunspot region 3664 produced additional flares and non-Earth directed CMEs in the days that followed with one flare attaining X8.7. A CME must be Earth-directed for its charged particles to be captured in the Earth's magnetic field for a geomagnetic storm. To illustrate, the May 8th flare was far below the intensity of the largest recorded solar flares, **Table 2**, yet the CME hitting the Earth, as opposed to solar flare magnitude, created an extreme geomagnetic storm.

For the amateur radio community, the event produced a range of experiences that included auroral scatter communication, noise interference, equipment failure and visual aurora.

Auroral Scatter

While the extreme geomagnetic storm blacked out HF communication, enterprising and curious amateurs experimented with auroral scatter on the VHF. In the Pacific Northwest there was activity on the 2m and 6m bands, example communication is listed in **Tables 3 and 4**.

CW is typically used for auroral scatter as the mode remains copiable in the presence of severe raspy distortion caused by backscatter from the aurora.

Noise Interference

On Saturday May 11th during a scheduled Earth-Moon-Earth (EME) operation event, participant VA7MM noted continuous S9 noise present in the station's 23cm EME receive system. On analysis it was discovered that side lobes on the station's antenna were sufficiently aligned with the sun's offset angle from the moon to pick up sun noise when the 10.7 cm solar flux index was peaking at 255 during the event operation. Under normal circumstances the

antenna side lobes, down about -20dB, would not be a problem or even noticeable if aligned with the sun offset. The noise present in the receive system degraded the signal to noise ratio and reception of the weak EME signals throughout the day. On the next day, Sunday May 12th, the S9 noise level was no longer present and EME communication returned to normal.

Transponder Silenced

A transponder-carrying pico balloon, VE7VDX, was launched from Maple Ridge, BC, by the North Fraser Amateur Radio Club on May 8th, 2024 at 8:57 AM. It achieved a stable altitude of about 12,850m (42,000 ft) with a payload that included a WSPR beacon transmitting 10mW of RF to a 20m dipole. On May 10th, 2024 the balloon was stable and floating in the jet stream above Colorado, when its transmissions suddenly ceased, **Table 5**.

Table 5: Last WSPR Spots of VE7VDX from DM79, Colorado, 19:40 UTC, May 10, 2024

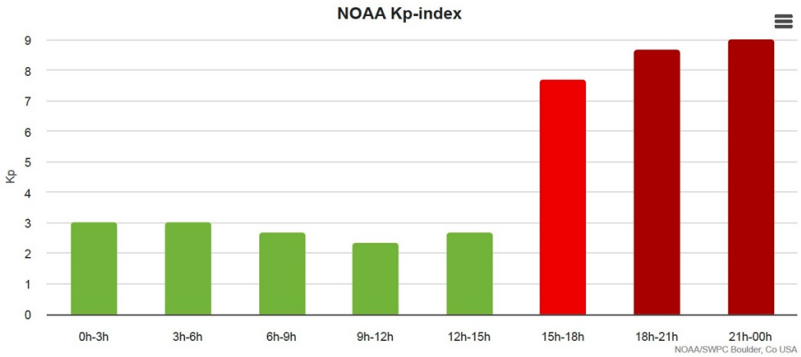
RX Call	RX Grid	Frequency (MHz)	SNR
N6GN/K	DN70jo	14.097120	3
W0DAS	DN70mq	14.097120	3
WD0E	DM79qm	14.097119	2

Source: http://wspr.rocks/

Adrian Stimson, VE7NZ, a partner in the amateur radio pico balloon initiative, reported the CME energy as a 'bulls eye hit' on the last reported balloon position over Colorado. The transponder's silence was coincident with a rapidly increasing Kp index that attained 8.67 when the beacon went silent, **Figure 2**.

The team reported the balloon was reporting reliably up to the moment the storm hit the Earth. It had been flying at a very stable altitude for two days, and it was reporting perfect voltage at the solar panels on its last transmission.

Figure 2: NOAA/SWPC, Boulder, Planetary K Index Report for May 10, 2024, UTC.



A balloon burst was discounted as a burst would have taken 20 minutes or more to reach the ground where line of sight WSPR stations monitoring at the time would have recorded and reported the sudden drop in altitude, but this was not observed. The balloon team reported the Raspberry Pi computer onboard would normally reload the firmware on power up but this did not happen in the days following the CME arrival, so it is presumed the balloon flight continued its way around the Earth in silence.

Visual Aurora

Though the solar flares on May 8th were average, the Earth directed CMEs they produced caused visual aurora that was widespread over both hemispheres with visible aurora reported in Hawaii in the northern hemisphere and in Queensland, Australia in the southern hemisphere. The NOAA space weather forecast on 07:35, 11-May-2024, UTC showed a high

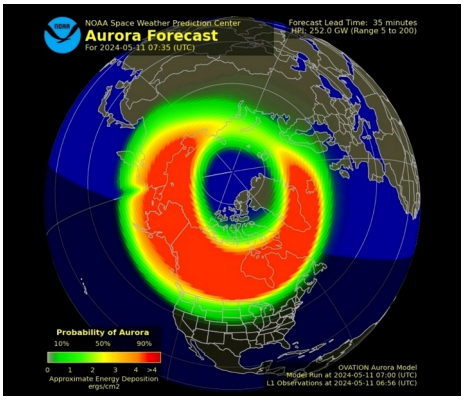


Figure 3: *Auroral forecast at 0010, 11-May-2024, UTC, showing high probability over most of Canada. Source: NOAA.*

Figure 4: *Visible aurora over the Strait of Georgia at VE7SL, Mayne Island, BC, 11-May-2024. Photo: S. McDonald VE7SL, 2024.*

Figure 5: *Visible aurora over the 23cm EME antenna at VA7MM, Coquitlam, BC, 11-May-2024. Photo: M. Mattila VA7MM, 2024.*

probability of visible aurora over most of Canada during the G5 storm, **Figure 3**. South Coastal British Columbia was blessed with clear skies during the storm enabling fantastic aurora to be observed over the entire sky, **Figures 4 and 5**.

Scientific American reported online on May 10th that sunspot 3664 was approximately the size of the sunspot that triggered the Carrington Event in September 1859. On the comparator of sunspot size, the auroral display was a Carrington scale event.

Day (UTC)	Spot Count	Remarks
May 9, 2024	5,900,000	Typical Count April, May
May 10, 2024	4,200,000	
May 11, 2024	300,000	Most deemed to be ground wave propagation
May 12, 2024	2,200,000	
May 13, 2024	2,600,000	
May 14, 2024	4,900,000	

HF Blackout

Adrian Stimpson VE7NZ, has been monitoring daily global 15m FT8 spots for an NOAA study. A typical number of global FT8 spots during the months of April and May is about 5.9 million spots per day. During the peak of the geomagnetic storm the global daily spot count plummeted to 300,000 spots on May 11th, **Table 4**.

The spot count on May 11th is deemed to be largely regional ground wave communication. Over the following days there was a slow recovery of HF communication with spots returning to the 6.0 million spots per day level on May 22nd.

Table 4: *Total FT8 Spots on 15m by Day*

Looking Ahead

Fortunately, the space weather of May 2024 had few reported impacts on potentially vulnerable electrical and communications infrastructure. In the United States, the Federal Communications Commission and Public Safety and Homeland Security Bureau issued a Public Notice seeking comment on any observed impacts to communications that resulted from the May 2024 severe geomagnetic storm. It is generally understood that the use of fiber optics in communications today contributed to the resilience of commercial telecommunications infrastructure during the event.

The solar flares of May 8th were not particularly intense with ratings at class M and X1.0; however, the three Earth directed CMEs from those flares created an intense geomagnetic storm that persisted for over a day and created widespread aurora visible in both northern and southern hemispheres to equatorial latitudes.

As solar cycle 25 is currently well underway, more solar storms and geomagnetic disturbances will occur. The amateur radio community can look forward to more instances of their equipment being affected and propagation being impacted.

~ Mark Mattila VA7MM

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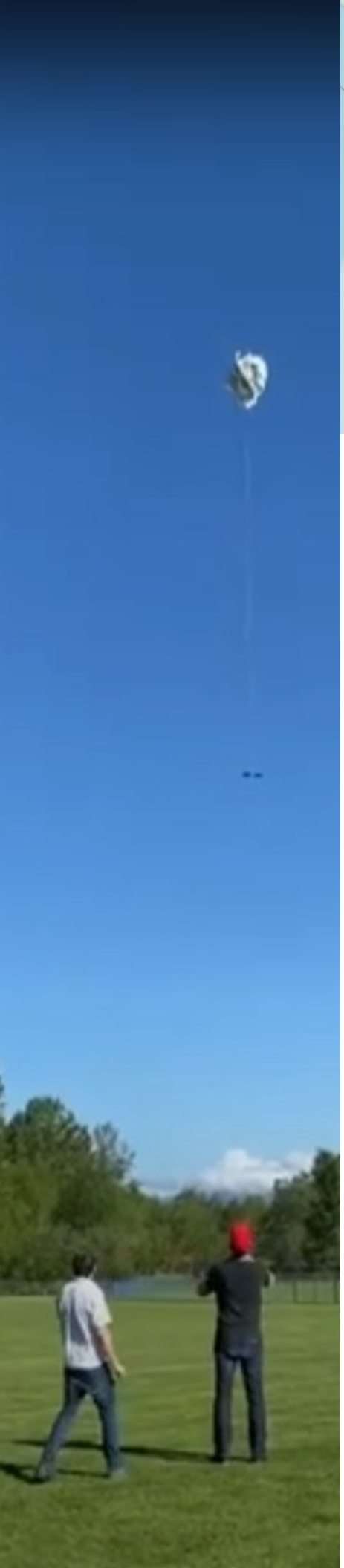


A Successful Balloon Launch

This is the most successful one to date for our group

by ADRIAN STIMPSON VE7NZ

June 21st at 11:32am PDT / 1832 UTC, we (VA7SL, VE7NZ, with software support from VE7SLZ) successfully launched our 11th pico balloon in an attempt to circumnavigate the Earth. It is now over North Dakota and you can follow it here:

https://amateur.sondehub.org/#!mt=Mapnik&mz=5&qm=12h&mc=49.1817,-101.95313&f=VE7NFR&q=VE7NFR

Video of launch (rated E for Everyone) and other info at: https://ve7nfr.com/pico-balloons.html

- **Technical details**

Mission name: Apollo (https://qrp-labs.com/track/track_Apollo.html)

Payload weight: 18.6 grams

Total lift / free lift: 24.3 grams / 5.7 grams

- **Balloon**

32" Orbs, pre-stretched to 102" circumference for three days (this determines pressure at float) (https://balloons.online/ca/orbs-32-silver/). Silver not removed. Kapton tape added to top seam, reinforced payload attach point, glued + taped fill valve.

- **Target float**

13000m +/- , which we have achieved!

- **Tracker**

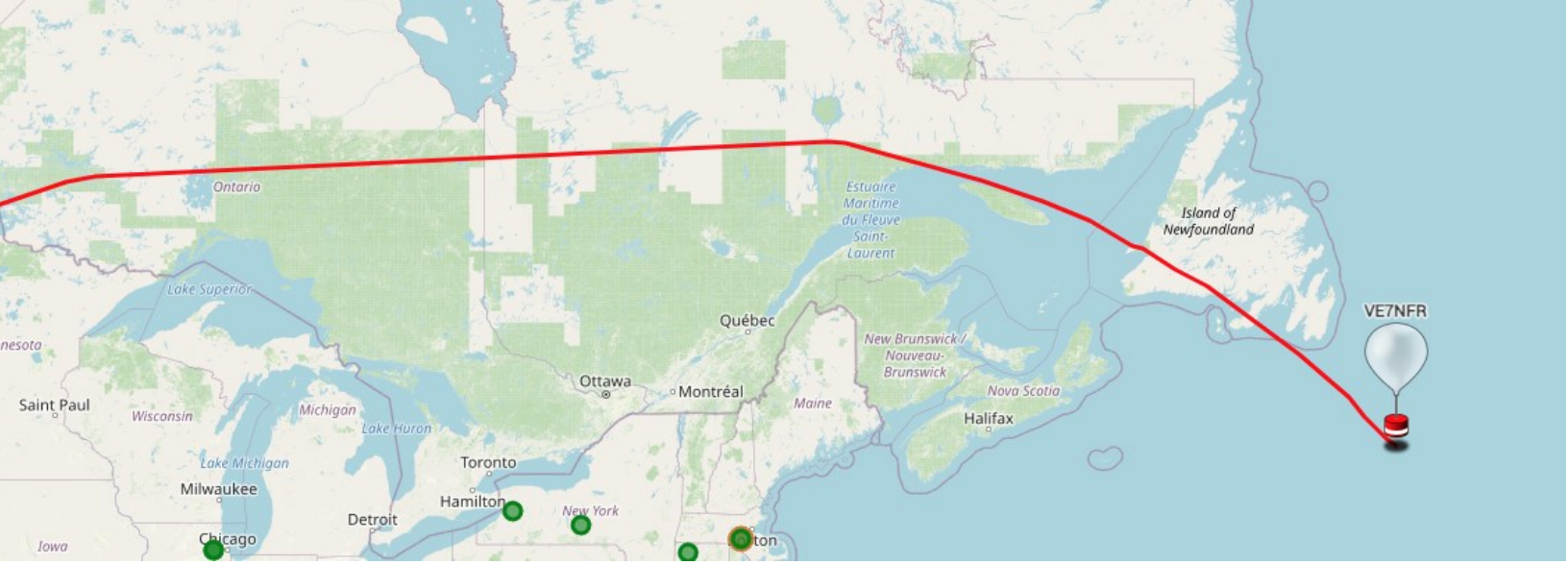
Traquito (uses Pi-Zero - with thanks to VE7TOA for last minute replacement of our non-working unit), 20m WSPR into half-wave dipole made of 38 gauge magnet wire (yes, just 0.10 mm diameter), putting out a massive 27 milliwatts every ten minutes.

- **Power**

2 powerfilm solar panels, max 6VDC, shunt regulated to 4.9V max to protect the 3F supercaps used to buffer/store.

- **Gas**

Hydrogen



- **Other**

Glue - Loctite for extreme cold (rated to -40C); Kapton tape; inline swivel to address propellor behaviour (which happened at launch to be sure); Kastking 15 lb fishing line.

- **Coffee**

Yes, one cup each before launch.

As of this report, the balloon appears to be exploring the Atlantic Ocean. There are currently no updates. Perhaps it is out of range of monitoring stations, but we believe the failure was that it hit a sudden high pressure system as it ventured out over the Atlantic, as we saw a significantly fast increase in altitude over 13,000m. That would also put it at some of the coldest temperatures on the flight (-43 C) making the balloon brittle and susceptible to breaking as it expanded relatively quickly.

The balloon supplier now offers a balloon specifically for ham operators that is clear plastic and we think the greenhouse behaviour of that (vs. the reflective silver coated balloon we used) will help keep the balloon a little warmer and more "stretchable" for the next flight.

Our focus returns to planning the upcoming high-altitude balloon launch now and we will return to our circumnavigation goal after that.

While monitoring this, we are returning to the High Altitude Balloon (HAB) launch planning which will be two launches.

The first will have a new and improved cross-band repeater (UHF/VHF) as well as a camera that will capture a photo every 20 seconds and send it to an SD Card. We hope to recover the payload of course. We will be testing a new aerodynamic stabilization design with the help of David VE7KZ. Look for news on this in the next 7-10 days if all parts arrive and work as we hope.

We are still working on live video over the 70cm band for the second HAB launch but it's early in assembly and testing of that to say much more yet.

Thanks as always for your donations to our crowd funding (link on https://ve7nfr.com/pico-balloons.html). We did this launch nearly entirely on parts purchased before the crowd funding leaving funds for the upcoming HAB flights.

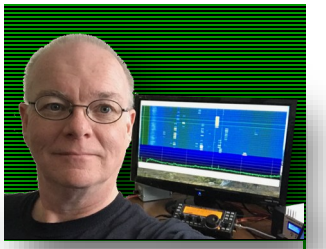
~ Adrian VE7NZ & VA7SL, VE7SLZ

PS: any comments about balloons being shot down will be forwarded to the "yes, you're not the first person to say that" auto-reply bot.

Auroral Propagation

Six Metres Auroral Propagation Event – May 10/11, 2024

by KEVIN McQUIGGIN VE7ZD / KN7Q



Kevin VE7ZD/KN7Q is active in EME, meteor scatter and much more. He lives on Vancouver Island

Readers may recall hearing of a significant solar event that occurred on May 8th, 2024 [1]. An active region on the surface of our Sun experienced multiple solar flares and several CMEs (coronal mass ejections) were emitted towards Earth. These eruptions were repeated on May 9 and May 11.

The CMEs arrived at earth on May 10th and were responsible for enhanced aurora borealis that reached as far south as Mexico, Hawaii, and Puerto Rico. See Figure 1.

The unusually strong aurora had significant impact on amateur radio communications on the 6m band. Aurora can reflect radio waves, and this resulted in unusually strong propagational effects.

Amateurs active on 6m noted the strange effects, and the band sprung to life for about 24 hours as operators all over the world sought to take advantage of the auroral propagation.

I am an active 6m operator, and while I was not aware of the solar event at the time, I happened to be on the air, and noted that FT8 signals on the band (50.313 MHz) became strangely indistinct. Seemingly strong signals would no longer decode. FT8 signals are

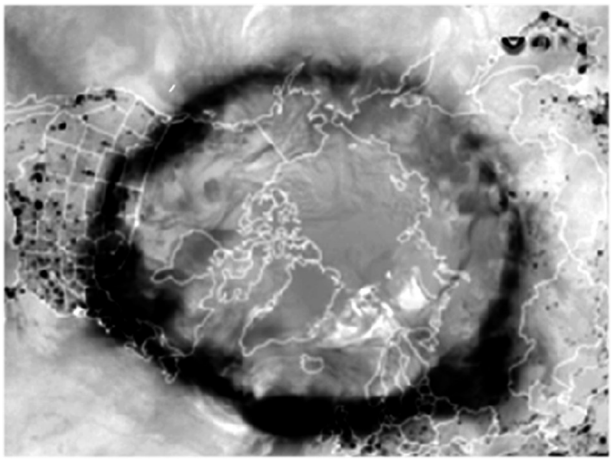


Figure 1 – Aurora Borealis over Northern Hemisphere on May 10-11, 2024 [2]

normally about 50 Hz in bandwidth, but the signals started to spread out: first to 60, and then 80, then 100 Hz in bandwidth.

It was clear that something strange was happening.

I checked the "Slack" VHF-Chat channel (see [3]) and noted that other 6m operators were seeing the same strange effects. While propagation seemed to have greatly improved (lots and lots of FT8 signals on the waterfall), few of them would decode.

The collective decision was to move from FT8 to the more resilient Q65 digital mode. Q65 (a sub-mode provided by the popular open-source WSJT-X software suite) is designed for weak signal work and is very tolerant of signal fading, and also of frequency drift in incoming signals.

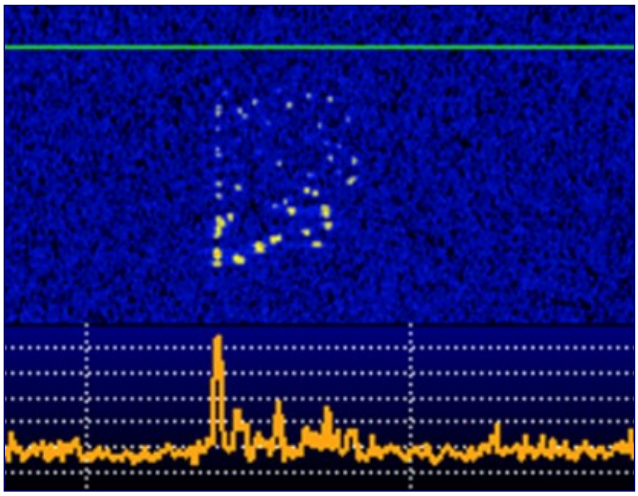


Figure 1 – Normal Appearance of Q65 Signal [4]

Figure 1 shows what a "normal" Q65 digital signal, one with no spreading or fading, looks like. Note the distinct tones that appear on the waterfall (as dots that change over time). The Q65 sequence normally used on 6m is 30 seconds in duration.

The aurora had huge impact on how the Q65 signals looked. Multiple reflections of signals on the heavy ionization in the upper atmosphere due to the aurora caused signals to spread out to several hundred Hz in bandwidth. Tones became indistinct and were spread left and right due to the multiple paths caused by the huger level of ionization. The whole waterfall looked like it had been "smeared" by an imaginary paintbrush.

This was amazing to see, and many 6m operators commented on this as we tracked the propagational effects of the aurora.

See Figures 2 and 3 for two examples of how the Q65 signals appeared during the auroral event.

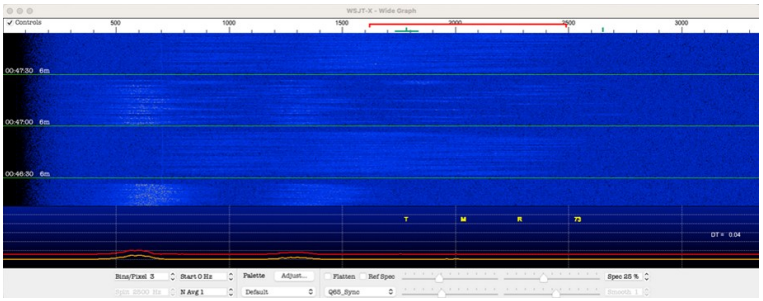


Figure 2 – Auroral Effects on 6m Propagation (May 10, 2024) [5]

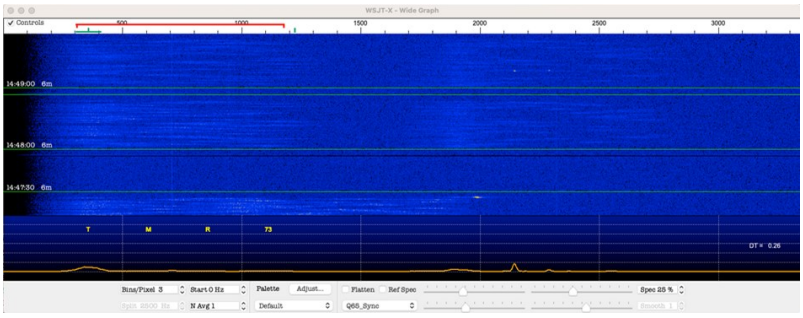


Figure 3 – Auroral Effects on 6m Propagation (May 11, 2024) [5]

Amazingly, most of these smeared signals were decoded by WSJT-X and many of us made QSOs through the ~24 hours of this exceptional period of propagation.

The CME effects wore off and propagation returned to normal by about May 12th or 13th.

This was a very interesting propagational event. I had never personally experienced auroral propagation but was able to make several contacts on 6m using Q65. Some hams made CW and SSB QSOs on 6m, but the spreading and multi-path caused by the aurora made these contacts challenging. I learned that FT8 is unusable in this kind of solar event, but that the features of Q65 can compensate for the spreading effect of auroral propagation.

WSJT-X is available at https://wsjt.sourceforge.io/wsjtx.html. It includes the very popular FT8 mode but also several less well-known digital modes including Q65.

~Kevin VE7ZD / KN7Q

References

[1] See https://en.wikipedia.org/wiki/May_2024_solar_storms.

[2] Image from Wikipedia, see [1].

[3] See https://vhf-chat.slack.com.

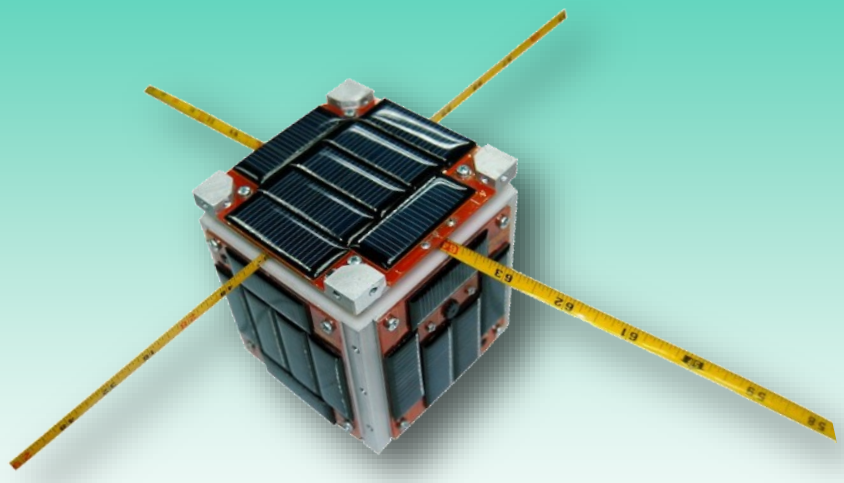
[4] From the image at https://k5nd.net/wp-content/uploads/2023/03/Q65-K5ND.jpg.

[5] Author's screen captures from May 10 and 11, 2024.

94 km 10 Ghz contact made

On June 25th, Dino VE7NX and Scott VA7SC set up their 10 Ghz stations and made a direct 10.3 km contact between Boundary Bay and Crescent Beach. Then they decided to bounce off Mount Golden Ears over a total distance of 94 km. Scott was running 612 W effective radiated power and Dino only 100 mW.

Satellites



SARC now has a satellite station – ready for field day

By JOHN BRODIE VA7XB

The SARC Directors recently approved a project, under the leadership of Dino VE7XDT, to construct a club station capable of making contacts via satellites. A few of us have done this previously at our home station, or are equipped to use a portable setup with an Arrow antenna and handheld radio. But for most of the group, it was to be a new experience.

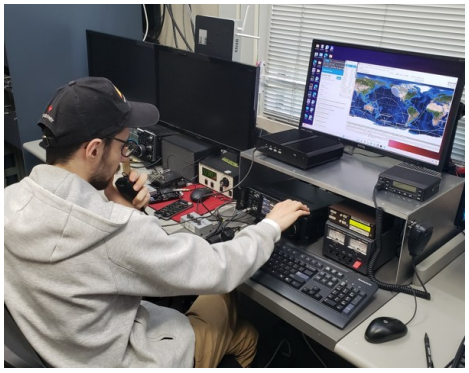
We already owned an IC-9700 transceiver, in which Dino had installed a module for stabilizing frequency drift. The Projects group met during the winter months to confirm equipment purchases, then bought what we needed and commenced to get it underway . We decided to go basic and upgrade it in future, depending on the level of interest.

Equipment purchased included:

- Yaesu G-5500DC AZ-EL rotator and control box
- Yaesu thrust bearing
- FoxDelta SD2 USB Tracking Interface
- Diamond A144S5 2m 5-el Yagi
- Diamond A430S10 440 MHz 10-el Yagi

Dino VE7XDT, who provided the inspiration, planned the project and got us started.

John VA7XB making final adjustments to the antenna alignment on the roof



Adrian VA7YEP making first contacts with the new setup.

Dino VE7XDT reviewing the concepts to Mike VE7YEG , Robert VA7FMR and Steve VE7SXM.

- 120 ft. of LMR-400 Ultraflex cable
- Mini PC
- SatPC32 satellite tracking software from AMSAT

John VA7XB fabricated the stand, by bolting together 1.5" angle aluminum for the rotators and antennas. When completed, the stand was moved out of John's garage onto the flat roof of our Ops Centre, with coax and control cables connected to the controller for 2m and 440 Mhz. Planned for the future is 1.2 GHz capability.

Why did we not use cross yagis as is the usual practice? The loss from circular polarization (LHCP and RHCP) compared with linear polarization is only 3 dB which is easily compensated by using the internal preamp of the Icom IC 9700. The cost of a cross polarization antenna with appropriate switching is far more expensive and it's hard to justify for a basic setup.

The controller can move the antennas 450 deg in azimuth and 180 degree in elevation as directed by the Foxdelta Tracker. The SatPC32 software controls both the tracker and the frequency, adjusting for Doppler shift.

The project took approximately 6 weeks to complete, from the time of ordering components to making the first contact. At the end, a day was devoted to getting the tracker, radio and controller all talking to each other. Since neither Dino nor I had used SatPC32 for several years, we had to re familiarize ourselves with how they all work together.

At first we just listened. Then on Saturday, June 8th, two members made successful contacts with the linear and TEVEL satellites and the International Space Station (ISS). The rest of us just watched and learned. We will use the coming months to explore the details of this fascinating communication mode, perfect our technique and start filling in the log.

I knew nothing about TEVEL satellites, so I looked it up and here is what I found:

Tevel [Herzliya Science Center] The Israeli Tevel is a mission with eight identical CubeSats developed and built by students of secondary schools at the Space Laboratory of the Herzliya Science Centre (HSC). They are built to the 1U CubeSat standard. The FM amateur radio transponder is the only payload. How cool is that?

Already experienced with satellite communication, Adrian VA7YEP has taken on the job of satellite station manager and will assist in coaching others over the next few months. First assignment: Field Day!

~ John VA7XB

The Sinatra Method

for DIY Ham Radio Projects

by JOHN CORBY VA3KOT

I recently watched Hans Summer G0UPL's presentation at Hamvention 2024 on YouTube. Hans talked about 10 of his junk box projects. As you probably know, Hans is the owner of QRP Labs, a small company that makes excellent QRP radios and accessories and sells them for an unbelievably low price. I really enjoyed the presentation, especially since I was able to identify with the techniques presented.

Step #1 – accumulate junk. You can make stuff with junk. Roger that, my junk piles fill a closet in my shack. Then there is another junk pile in a room in my basement, and another that occupies several storage shelves in my garage. Then there is another one in my shed. I accumulate scrap electronics from which I salvage parts. I accumulate bits of metal – especially metal poles and tubes. I also accumulate scrap plastic – I especially love plastic, it can be shaped and molded, melted and welded.

Step #2 – use your imagination. I rarely buy anything I can make myself. I get great satisfaction from building stuff I have made myself. And I don't always follow the rules. Remember, this is ham radio outside the box. I call it the Sinatra method – "I did it my way".

This little rig of mine, I'm gonna let it shine

A fellow club member always buys everything he uses in his amateur radio activities. He believes that appearance is priority #1. We have discussed our different approaches several times. He has spent thousands of dollars acquiring shiny pukka gear that would win an

John Corby VA3KOT resides in Owen Sound, Ontario but is more often found operating CW out in the "Big Blue Sky Shack". He especially enjoys activating parks for the POTA program and blogging about his experiences at HamRadioOutsidetheBox.wordpress.com

equipment beauty contest for sure. But, I wonder if his approach would work in a SHTF situation when it simply wasn't possible to buy commercially available equipment.

Electronic alchemy – turn base metals into ham gold!

There are a number of prerequisites for employing the Sinatra method. First, you have to have accumulated your junk pile. Everything you need should be right where you can reach out and grab it. And you need imagination (see step #2). When you look at a pile of junk you should be able to see possibilities – "I wonder if I could use that widget to make a…"

Money can't buy me love

Then you need time, tools and – most importantly – aptitude. But aptitude is in the mind. "I can't…" can be turned around to "I can learn how" with a bit of positive thinking. Eventually you will learn to love being a maker. There is one thing you don't need – money! Well alright, a little money to raid the charity stores for some second-hand tools. You can save a lot of money by building your own stuff. Hey, enjoy ham radio and get rich in the process!

Here are some of my "Sinatra" projects:

My first ever HF radio, the original pre-ND Yaesu FT-817, did not have a CW memory keyer so I built one. It uses an Arduino nano chip that I got for nothing in a trade. The code for the keyer was written by K3NG. My version uses a rotary encoder to change speed on the fly – useful in POTA activations when responses from hunters vary greatly in speed. Clicking the rotary encoder knob sends my CQ POTA message – a great convenience when things are slow and I need to send CQ repeatedly. It is powered by a Lithium Ion power bank that I bought for a song in a charity store.

That same FT-817 did not have any IF filtering – relying instead on an optional Collins mechanical filter that is now unobtanium. So I built an audio filter from a quad op-amp chip that cost me less than the price of a coffee.

The circuit was built inside an Altoids tin. Not as good as an IF filter but it does separate the signals in a crowded band when needed.

The VA3KOT QROp field rig has featured in several posts on this blog. It is an ever-evolving project comprising a Yaesu FT-891 built inside a 50mm steel ammo case. These steel boxes are designed for holding 100 rounds of 50-cal ammo and other ordnance. They are tough. I blunted a step drill bit making vent holes in the top. My radio is safe! This steel box was a major purchase – it cost me 35 bucks, ouch.

Note the use of U-bolts for protecting the head unit. If the rig ever falls on its face this protection keeps all the knobs a few millimeters away from danger. Imagination, see, I looked at those U-bolts in my junk pile and saw an innovative use for them.

My Bioenno LFP battery sits outside the ammo case, in a mil-spec canvas pouch, so it can be used with other radios as needed. I needed a way to get the DC into the ammo case. No problem I thought, I'll order an Anderson Powerpole panel mount. Then I saw the price of panel mounts and gasped.

My Bioenno LFP battery sits outside the ammo case, in a mil-spec canvas pouch

Imagination to the rescue. I cleared my workbench and spread out several bits of junk that might be adaptable as a panel mount. One of the junk bits was a plastic ferrule designed to secure steel jacketed AC cable at the entry of a junction box. Yes, that just might do it, I thought.

I grabbed a couple of spare powerpole connectors without the contacts and tried them inside the ferrule. Almost perfect; a little reaming with a Dremel tool and a perfect match was made.

But the connectors had to be secured so that they wouldn't move as the mating connector from the battery was inserted. Hot melt glue did that job and did it well. I bored out a large hole in the aluminum panel with that same step drill bit that had suffered and died making the vent holes in the steel ammo case. It is only good for making holes in soft plastic now.

The cable ferrule has a tapered end that snapped cleanly into the hole in the front panel. Now I have an Anderson Powerpole panel mount that is entirely functional but is beautiful only in the eyes of a Sinatra method DIY enthusiast.

Incoming ... grenade!

There have been numerous other projects over the years. I could have followed the trend and bought genuine arborist throw line kits for launching antennas into trees. But, not me – I did it my way. I bought some party balloons and mason's twine at the dollar store. The party balloons were filled with sand (free from a local beach). I call them "Sand Grenades"; they do an excellent job of getting wires into trees.

Oh wires? Yes, every antenna is a DIY job. I've built – not bought – many of them. Buy wire when its on sale, make end insulators and winders from scrap plastic.

What's it all about Alfie?

When you choose to build your own gear you learn. Some stuff works and some doesn't. Brag about what works and bury the failures in the backyard! And don't call me Alfie.

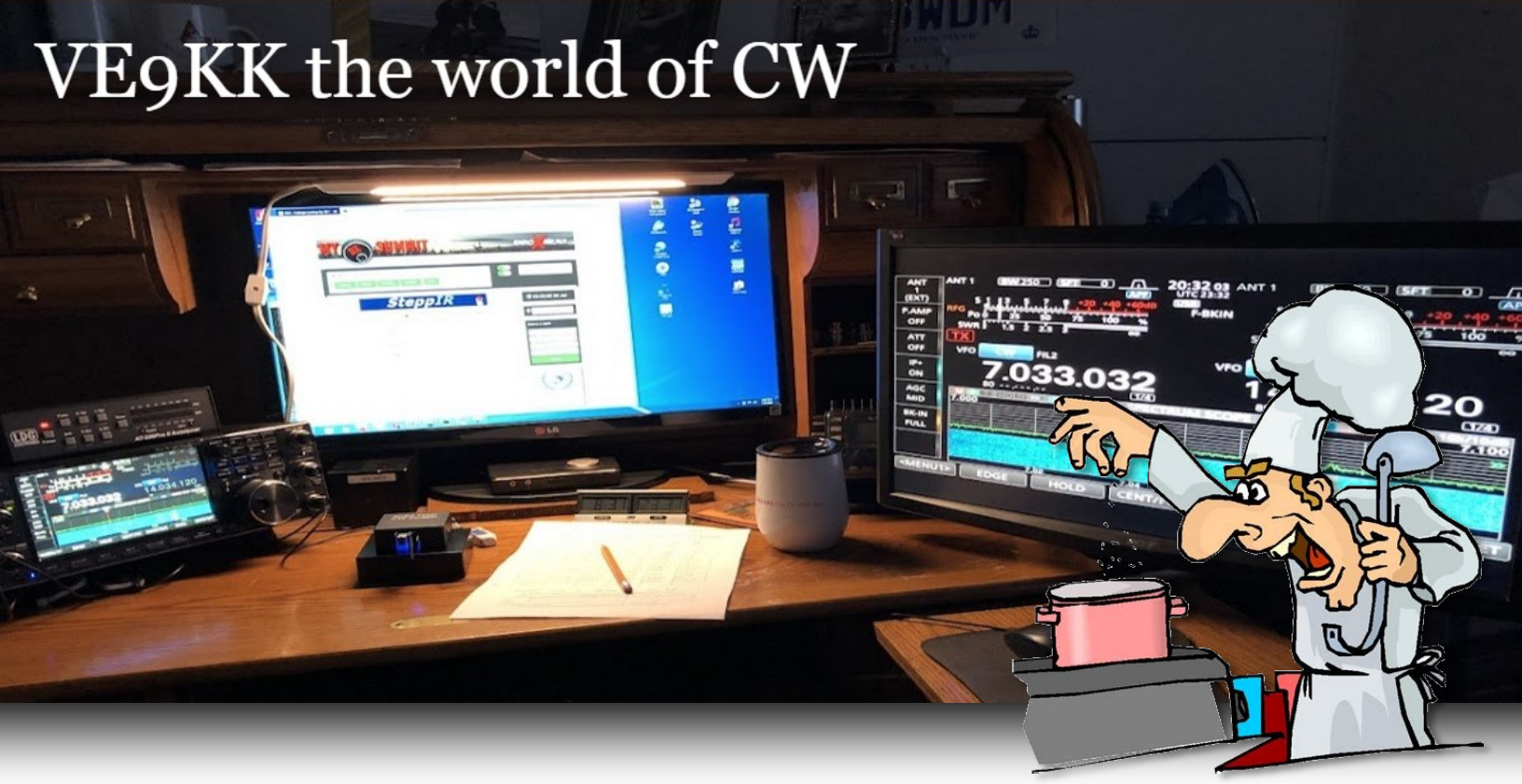
Money, money, money – it's a rich man's world

If I had a million dollars… I would still prefer to make my own gear – my way. So no donations accepted – unless you have some "worthless" junk you need rid of!

Regrets, I've had a few, but then again too few to mention…

~ John VA3KOT

VE9KK the world of CW



So you're a chatty Kathy

What CW recipe do you want to learn

by MIKE WEIR VE9KK

Mike Weir VE9KK was first licensed in 1989 and upgraded to advanced in 2000. He primarily operates contests both CW and RTTY.
His blog is at: VE9KK the world of CW

Yes, you read it correctly… within the world of CW there are recipes that one finds they are following but before you follow a recipe you have to learn the ingredients for that recipe. The CW recipes that I am aware of are POTA including the other variations, conversational CW, DXpedition hunting and contesting. Most who want to learn CW do so with a particular interest in mind. Every recipe involves ingredients and each of the above CW recipes involves certain recipe ingredients that one needs to learn and get better and better at. So in part 1 let's begin with the one I am most familiar with… contesting. This was the main reason I wanted to learn CW.

If you are interested in contesting then what are the ingredients for CW contesting… Letters, numbers, speed and accuracy. How serious you want to get will determine such areas as speed but letters, numbers and accuracy will always be a mainstay in the recipe. Once you have the letters and numbers down you are then good to go for call sign and number string practice. There are many call sign and number practice programs on the internet.

There is LWCO, Morse Code World, Morse Code Ninja and then there are programs as well such as Morse Runner, G4FON contest and RUFZxp contest programs to name a few. Best of all there is the real deal and that is getting on the air and operating contests. Start out doing search and pouncing call signs in a contest. Avoid call sign spotting programs as these do not exercise recall, retention and eventually instant recognition. As you continue to practice you will find with some letters and numbers that instant recognition is happening.

There is a rhythm to CW contesting and you will find like all of us you will get used to the rhythm… how do I know this you ask? Well in a contest when a station goes off script you can get lost. For example, you get asked to QSY to 14.023 or PSE UR CALL AGN not to worry as I have read even the seasoned contesters get thrown off now and then. In contesting you will only have to instantly recognize a few phrases. Such as NR?, TU, and AGN? (sometimes with or without "?") and that is about it.

There are some things if you choose you don't have to worry about in contesting. Because contesting programs such as N1MM+ do everything for you. Sending manual code is optional as macros within N1MM+ look after everything. You won't have to worry about recognizing common QSO words and phrases.

So what will contesting do for you… your code accuracy will improve, your speed will improve and instant recognition will happen. Also when you dip your toes in the big boy pool and call "CQ TEST" you will have the joy of multiple stations coming back to you. The brain is an amazing thing and I can attest to the fact that when you practice (using the above-named contest programs) multiple stations come back to you in time your brain will pull out one station. You may or may not get the complete call but you will have something to go back to them with.

In closing the recipe of CW contesting can include as many ingredients as you like. As you master one you can add another and so on. Not all like contesting and that is why in CW there are other recipes one can follow. Next time we are going to look at the CW conversational recipe. As a side note to have access to the G4FON program you need to join the Long Island CW club or LICW. I am a member and its an amazing group. Check out the link and see what they are all about.

In part 2 of CW recipes, we are going to take a peek at conversational CW. QSO CW is like Apple pie for our U.S. friends or Peameal bacon for us Canadians. It has been around for a long time and is a staple of the hobby. What are the ingredients for CW conversation… for sure an understanding of the code. Getting your code speed to a comfortable speed but hey with this CW foodie, any speed can bag you a QSO. I would think this recipe calls for a code speed from 10-15wpm and then the sky is yours if you want. Also comfortable at using a key whatever type you choose to learn on. I would suggest a key as to the PC because with QSO CW the conversation can go in many directions if you let it. A PC can do the trick but then there are your typing skills you have to brush up on… why not spend the time mastering sending code? This recipe calls for spending some time getting the sound of QTH, RST, TU, 73 and so on. Compared to contesting there are more group sounds you have to become familiar with. As you learn the group sounds then head copying these sounds will kick in. Sure you can still paper and pencil it for the name, QTH and call sign but head copy of the common QSO

items puts you ahead of the game sort of speak.

Accuracy is always nice but it's like sugar, salt and pepper that can be added later on. During a QSO recipe if you mess something up not a big deal… its a matter of dit dit dit and try it again. Over time the rust will be sanded off and your code will be nice and shiny.

Just like when cooking something from a recipe where you have to taste it now and then, take it out of the oven to check on it or add a little more of something it is the same with QSO CW. You may be able to send very fast… faster than you can copy but remember those who do this can get burned as the person on the other end may come back to you at the same speed and you can heat up and get burned.

Also like cooking things can change and you have to add something. Same with QSO CW understand that conditions can change noise level, fading (QSB) or the other person's code is let's say… sour and hard to copy well you can only do your best with what you have and add the salt of your experience to understand the QSO. Finally just like in cooking when the timer dings the cooking is done and with QSO CW nothing wrong with hearing the timer and calling the QSO done.

With the QSO recipe getting to a speed of 10-15wpm is good, turn the power of your radio to zero and practice sending with our key, get to know the sound of common QSO terms, and remember that dit dit dit fixes most things. Most of all relax and enjoy as we have all have frozen, got lost in receiving code, messed up sending and wished we could just hit the power switch and walk away. It's all part of getting the right QSO recipe mix.

Here is a good links regarding the basic of a CW contact and making a CW contact

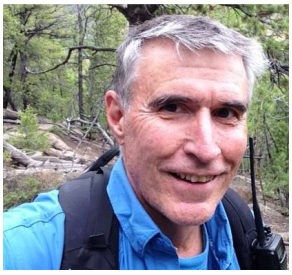
~ Mike VE9KK

Big Screen Mobile ATV! - thanks to KV5Y and the TV Repeaters REPEATER Newsletter

Operating Patterns

Among Canadian Amateurs

by BOB WITTE K0NR



Bob Witte K0NR maintains a great blog site at https://www.k0nr.com/wordpress/

Most active hams know many other hams and we think we have a handle on what ham radio activity is occurring. But our look into the hobby is limited by who we hang out with and the sources of information we consume. Also, we can see that the ham population is aging which is going to have a significant effect on amateur radio activity but we may not have any reliable data.

In general, the amateur radio community lacks publicly available data on amateur radio operating habits and demographics. So I was excited to see the Operating Patterns Among Canadian Amateurs authored by my friend Frank Howell, K4FMH. This report analyzes the survey of Canadian hams done by Radio Amateurs of Canada (RAC) in 2021. Frank is a Real Researcher, so he applies generally accepted statistical techniques to aid in understanding the data. I would have preferred a study of US radio amateurs, but it seems reasonable that the operating habits of Canadian hams would be similar to US hams (and perhaps a good proxy for other developed nations). Anyway, it is the data we have and it is probably useful. I encourage you to download the report and read it for yourself, but I'll comment on three findings from the report that strike me as significant.

Digital is really popular

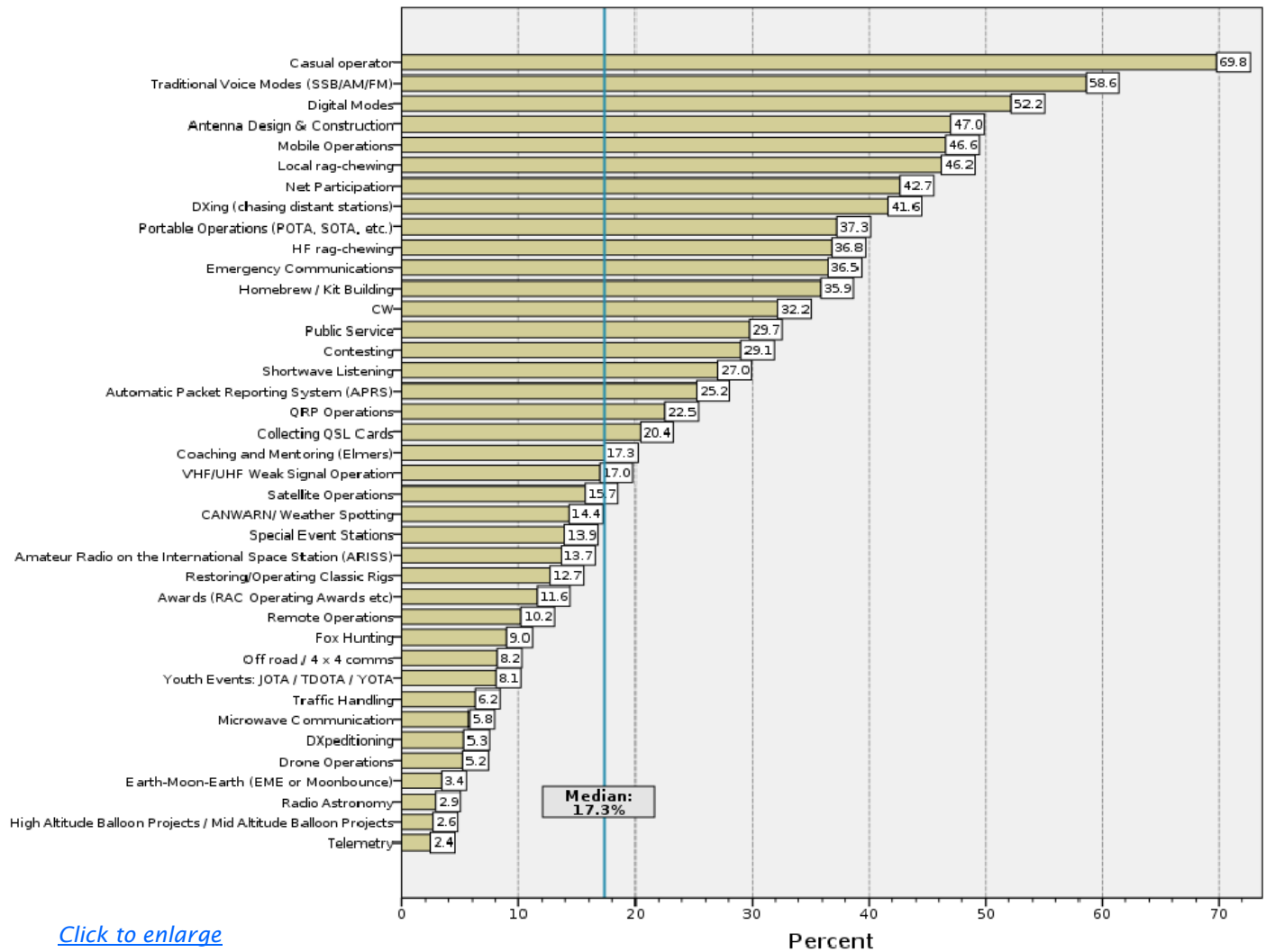
The figure below is a chart that shows the popularity of different operating activities. No surprise, Casual Operating and *Traditional Voice Modes* score very high. But number three is *Digital Modes*, almost as high as Traditional Voice Modes. Depending on your operating habits, you may be thinking "well,of course, digital is very popular" but others may think "really, people like doing that?" The report also points out that digital operation is correlated with age, with younger hams using digital more than older folks.

Ham careers can start at any age

Another interesting finding is that the classic stereotype of "young person discovers radio and pursues it as a lifelong hobby" is not universal. The report shows that people enter the hobby at a variety of ages and then pursue it with varying intensity. Quoting the report:

> *Thus, these data illustrate that our conventional image of the amateur who gets licensed early in life and maintains that hobby activity throughout is largely a stereotype.*

Figure 9. Activities by Canadian Hams, Ranked by Popularity



Click to enlarge

Source: RAC Survey 2021

Although it is one based upon real-world examples who fit it ideally.

I see this when teaching Technician license classes. The ages of our students typically span a wide range, including youth, but many of them are over 40 years old, entering the hobby later in life. In addition, we have quite a few students around retirement age (60 or so) looking for an activity to engage in during retirement.

The ham population is aging

You are probably thinking: duh, of course it is aging. The report puts some numbers on it, comparing it to the general population in Canada (see figure above).

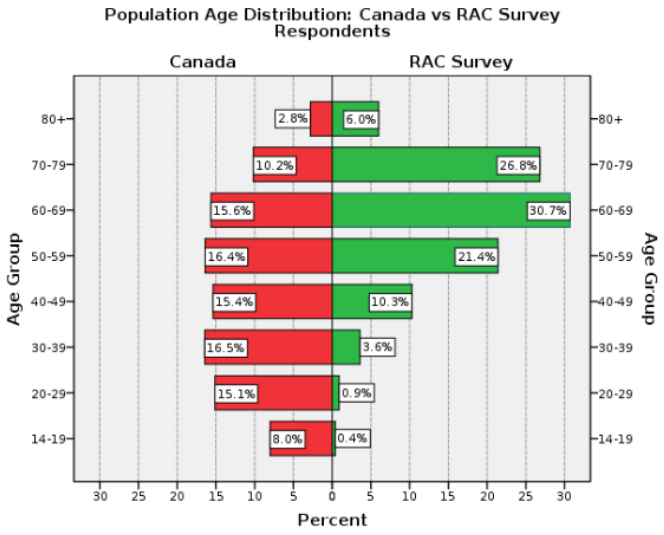
Clearly, the ham population is over-represented in the age groups above 50 years. Often, the conventional thinking is "we have to get the kids involved," which is a worthy thing to do. However, the report warns us that this won't be enough:

> *This pattern has two clear implications for amateur radio in Canada. One is that the age groups of 60-80 years of age, now dominating amateur radio as the RAC Survey suggests, will simply disappear as they age-out to infirmity or becoming Silent Keys. Yet, their non-ham radio peers are scheduled to grow in number. (A recruitment focus on late-in-life hams is a clear policy for RAC to consider.) A second implication is that teens will be a relatively scarce recruitment commodity in terms of the age pyramid. There will simply not be enough of them to replace those Baby Boomers now dominating the hobby, regardless of the recruitment resources directed toward them.*

This is not a call to give up on recruiting youth:

> *This should not be misconstrued to suggest that it would be a waste of time to expose young people to amateur radio as a recruitment method.*

Figure 3. Population Pyramid of Canadian and RAC Survey Age Groups



Source: RAC Survey 2021 and 2021 Census, Statistics Canada

More to consider

This post highlights three findings that I found to be interesting. There is much more information included in this report and I encourage you to read and ponder it. I'd certainly like to see more of this kind of work published, especially for the ham population in the US, Europe and Japan. I find the demographic analysis compelling, indicating that we will see a decline in the number of radio hams in the next decade or so. We can probably reduce this decline but not stop it (my opinion, worth at least what you paid for it.). Perhaps the way to think about the challenge is to focus on having a smaller but more vibrant and active amateur radio community in the future.

~ Bob KØNR

KB6NU's Ham Radio

Data on Amateur Radio Operating Habits

Ham gallery, M17 mailing list, 44-ft. doublet

by DAN ROMANCHIK KB6NU

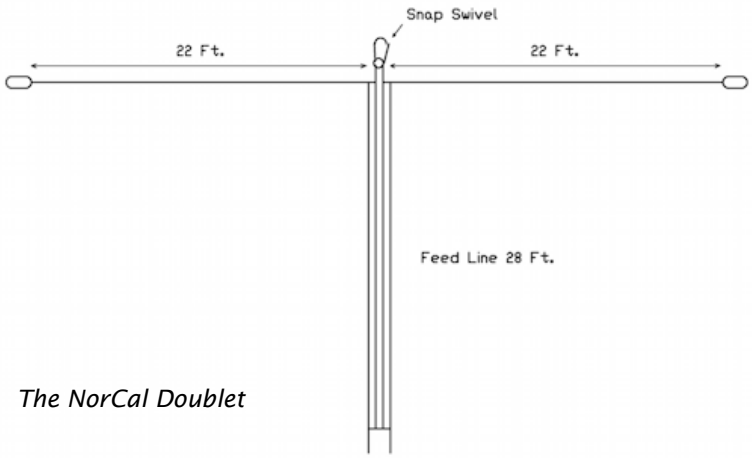
Dan Romanchik KB6NU blogs about amateur radio at KB6NU.com when he's not trying to figure out which way current flows. Dan teaches ham radio classes, and operates CW on the HF bands. Look for him on 30m, 40m, and 80m. You can email him at cwgeek@kb6nu.com

I've quit Twitter/X, and am now part of the Fediverse. There are quite a few radio amateurs in the Fediverse, and if you'd like to follow me there, you can follow @kb6nu@mastodon.radio. Mastodon.radio is a space for radio amateurs and SWLs, but it's not the only radio-focused Fediverse server. It connects with the servers listed on fediverse.radio, including mastodon.hams.social, a server here in the U.S.

Mastodon seems to have a much higher signal-to-noise ratio than Twitter. Here's a few links I found and things I learned on Mastodon last night:

K8CX Ham Gallery. K8CX has an interesting collection of photos from Dayton, DX sound clips, and a QSL card museum. I've submitted a couple photos of me and the ICQ Podcast crew at Dayton 2024.

M17 Users mailing list. The home page for this mailing list says, "The primary assumption of this mailing list is that M17 is (in June, 2024) in usable (enough) form for actual deployment and use in amateur radio." They believe that all the pieces are there now. Typically, to use M17, you'll have to be "somewhat of an experimenter" to work around the inevitable glitches in using M17, but in the opinion of this list founder, "all the pieces are there now".



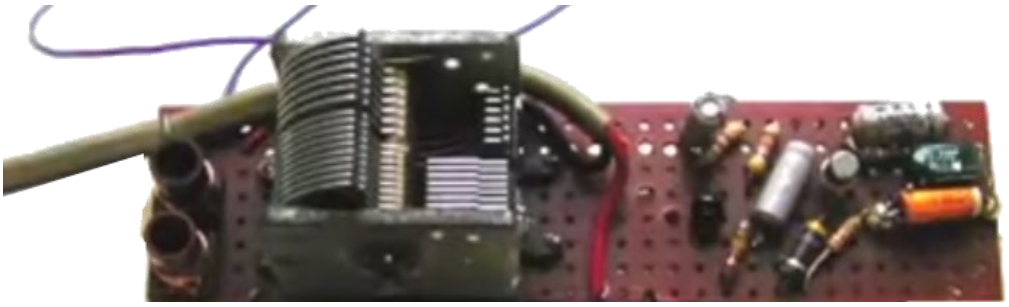
The NorCal Doublet

44-foot doublet. Last night, there was some discussion of portable antennas, mainly the 44-ft. doublet antenna. This is the antenna that L. B. Cebik describes on the web page, "1 Wire, 7 Bands, 2 Directions, or The 44′ Doublet as a 40-10 Meter Antenna." There's a similar antenna out there called the NorCal Doublet. The NorCal Doublet uses ribbon cable as the feedline to reduce weight. These two antennas look like they'd be worth experimenting with.

See you in the Fediverse!

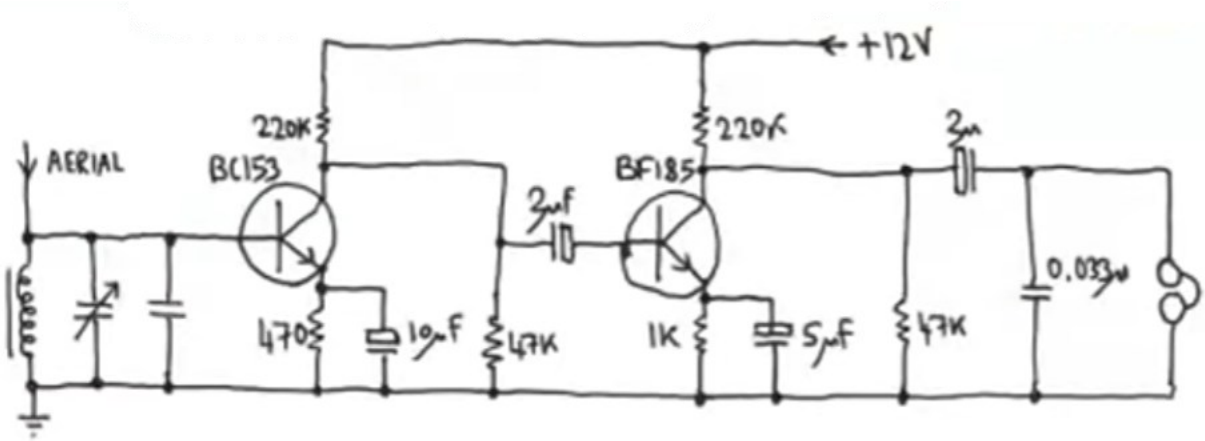
~ Dan KB6NU

A Simple Broadcast Band Receiver Project

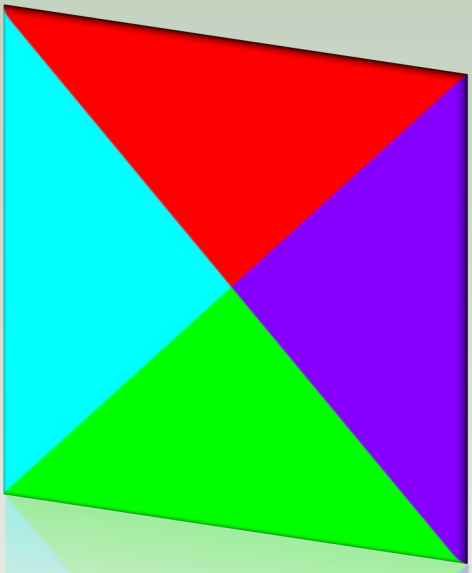


Hans Summer G0UPL has a presentation from Hamvention 2024 on YouTube. Hans talked about 10 of his junk box projects.

This is one of them.



Foundations of Amateur Radio



The origin of our amateur bands

by ONNO BENSCHOP VK6FLAB

Onno Benschop
VK6FLAB
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Full instructions on how to listen are here: https://podcasts.vk6flab.com/about/help

It's hard to imagine today, but there was a time when there was no such thing as either the 80m or the 20m amateur band, let alone 2m or 70cm.

Picture this. It's the roaring 20's, the 1920's that is. Among a Jazz Age burst of economic prosperity, modern technology, such as automobiles, moving pictures, social and cultural dynamism, the peak of Art Deco, we're also in the middle of a radio boom where the world is going crazy buying radios as fast as they can be constructed, there are hundreds of licensed broadcasters, the bands are getting crowded, radio amateurs have been banned from the lucrative radio spectrum above 200 meters, and can only play in the "useless short waves" using frequencies greater than 1,500 kHz. And play they did.

On the 2nd May 1925 amateurs proved they could communicate with any part of the world at any time of the day or night when Ernest J. Simmonds G2OD and Charles Maclurcan A2CM made a daylight contact between Meadowlea, Gerrards Cross, Buckinghamshire, England, and Strathfield, Sydney, New South Wales, Australia on what we now call the 20m band. This contact occurred not once, but regularly, for several days, using 100 Watts.

To give you a sense of just how big news of this feat was, on the second scheduled contact the Prime Minister of Australia, Stanley Bruce, sent a message to England's Prime Minister, Stanley Baldwin: "On occasion of this achievement Australia sends greetings."

If you recall, the IARU, the International Amateur Radio Union, was a fortnight old at this point. Less than a year later contact was made using voice.

Between the banning of radio amateurs from frequencies below 1,500 kHz at the London International Radiotelegraph Conference in 1912 and the Washington International Radiotelegraph Conference in 1927 the world had irrevocably changed. In 1912 the discussion was almost all about ship to shore communication. By 1927, the world had tube transmitters, amplitude voice modulation, higher frequencies and what the 1993 IARU President, Richard Baldwin, W1RU calls, "literally an explosion in the use of the radio -frequency spectrum".

In 1927 individual countries were beginning to control the use of spectrum, but there was no universal coordination, no international radio regulation and as we all know, radio waves don't stop at the border.

Richard W1RU, writing in 1993 says: "In retrospect, the Washington conference of 1927 was a remarkable effort. It created the framework of international radio regulation that exists even today. It had to recognize and provide for a multitude of radio services, including the Amateur Service. It was at this conference that amateur radio was for the first time internationally recognized and defined. Bands of harmonically related frequencies were allocated to the various radio services, including the Amateur Service."

While the IARU was two years old, it really hadn't represented amateur radio on the international stage, until now.

The 1927 conference defined an "amateur" as a "duly authorised person interested in radio electric practice with a purely personal aim and without pecuniary interest."

The harmonically related frequencies that were allocated to the Amateur Service are recognisable today. I'll use current band names to give you some context.

1,715 kHz to 2 MHz, or 160m, 3.5 to 4 MHz, or 80m, 7 to 7.3 MHz or 40m, 14 to 14.4 MHz or 20m, 28 to 30 MHz or 10m, and 56 to 60 MHz or 6m.

Of those, the 20m and 80m bands were exclusive to amateurs. The 10m and 6m bands were shared with experimenters and the 160m and 80m bands were shared with fixed and mobile services. You'll notice the absence of bands we use today, the 2m and 70cm bands, 15m and the so-called WARC bands to name a few.

The final ratified document goes into great detail about the requirements, the restrictions, how to deal with interference,

All podcast transcripts are collated and edited in an annual volume which you can find by searching for my callsign on your local Amazon store, or visit my author page: http://amazon.com/author/owh. Volume 7 is out now.

Feel free to get in touch directly via email: cq@vk6flab.com, follow on twitter: @vk6flab or check the website for more: http://vk6flab.com/

If you'd like to join a weekly net for new and returning amateurs, check out the details at http://ftroop.vk6flab.com/, the net runs every week on Saturday, from 00:00 to 01:00 UTC on Echolink, IRLP, AllStar Link, IRN and 2m/70cm FM via various repeaters.

If you'd like to participate in discussion about the podcast or about amateur radio, you can visit the Facebook group: https://www.facebook.com/groups/foundations.itmaze

This podcast episode was produced by Onno (VK6FLAB). You can find more at http://vk6flab.com/

how to allocate frequencies and numerous other provisions, many of which will look familiar, almost a hundred years later, if you've ever looked at the rules and regulations under which you operate as a licensed amateur today.

There were various radio amateurs at the 1927 conference, but as Richard W1RU puts it: "much of the credit for the success of amateur radio at that conference has to go to two representatives of ARRL -- Hiram Percy Maxim, president of ARRL; and Kenneth B. Warner, Secretary and General Manager of ARRL."

While Richard points to their roles in the ARRL, you might recall that Hiram was elected international president of the IARU and Kenneth its international secretary-treasurer.

Whichever way you look at it, whichever organisation you credit, today we have amateur bands thanks to those efforts made nearly a century ago.

~ I'm Onno VK6FLAB

The origins of the International Amateur Radio Union

In the early 1920's long distance communication using radio was a growing interest. At the time it was thought that communication that we take for granted today, over long-distance HF, was limited to long wave or extremely low frequencies, the lower the better. With that restriction came massive antennas and high power transmitters, available only to commercial and government stations.

Then radio amateurs let the cat out of the bag by discovering that so-called "short wave" radio could be heard all across the globe. As an aside, today, "short wave" seems quaint, because we've discovered that even shorter waves can be used to communicate, right down to nanometre communication as shown by NASA in its XCOM technology demonstration on the 12th of May, 2019. On a daily basis we use 120 mm and 60 mm waves when we use 2.4 and 5 GHz Wi-Fi for example.

As a result of the discovery of short wave radio, a gold-rush emerged. There was a hunger in the community for radio, businesses and communities adopted the new medium, there were radio courses being taught in Universities, church services and other forms of entertainment started filling the airwaves. Comedy, talk shows, music, concerts, serials and dramas spread across the electromagnetic spectrum and radio amateurs who had discovered the phenomenon were running the risk of being pushed aside by commercial interests willing to pay for access.

As I've said before, in many countries at the time, amateur radio was actively discouraged, sometimes it was even illegal.

Before we continue, I should quote some statements made about radio before the gold-rush which at the time was seen as "Telegraphy Without Wires".

In 1865 a Boston Post editorial proclaimed: "Well-informed people know it is impossible

to transmit the voice over wires and that were it possible to do so, the thing would be of no practical value."

Lord Kelvin, President of the Royal Society, said: "Radio has no future." and went on to say: "Wireless is all very well but I'd rather send a message by a boy on a pony", he also said: "Heavier-than-air machines are impossible." and "X-Rays will prove to be a hoax."

Not all statements aged as badly. The New York Times said in 1899: "All the nations of the earth would be put upon terms of intimacy and men would be stunned by the tremendous volume of news and information that would ceaselessly pour in upon them."

Back to the IARU. Before a business trip to Europe, the board of directors of the ARRL asked their President, Hiram Percy Maxim, to encourage international amateur relations, which on 12 March 1924 resulted in a dinner given, at the Hotel Lutetia in Paris according to Hiram, a "certain dining room" by "the most distinguished radio men of Europe."

Hiram goes on to say that: "This A.R.R.L. President has sat in at a good many very impressive radio meetings in the past, ranging from Maine to California, but he has never sat in at a meeting where there was quite as much thrill as at this meeting in Paris where the amateurs of nine different countries sat down together."

The countries were, France, Great Britain, Belgium, Switzerland, Italy, Spain, Luxembourg, Canada and the United States. Hiram remarks that "Denmark was represented by a letter in which regret was expressed at the inability to have a representative present and asked that the amateurs of Denmark be counted in." You should dig up a copy of the May 1924 edition of QST to get a sense of occasion where the ARRL president compares the thrill of the "hamfest" to the atmosphere during that dinner and pities those who have never experienced it.

During the meeting it was decided to form an organisation which was going to be called the International Amateur Radio Union. A temporary committee was formed that appointed Hiram Maxim as the chair and Dr. Pierre Corret as secretary to take charge of the details to create a permanent organisation. The final decision was to call for a general Amateur Congress on the Easter Holiday of 1925 where the IARU would be formalised.

On the 14th of April, 1925, 250 radio amateurs from 23 countries met in Paris and over the next four days the details of the new Union were hammered out. Among those details were that the organisation was chiefly for "the coordination and fostering of international two-way amateur communication, that it should be an organisation by individual memberships until strong national societies had been formed in the principal nations and a federation would be feasible, and that its headquarters would be located in the USA."

The constitution was written over a day and night session and by the morning of the 17th of April, every delegate had a copy and then the hard work began, approving the constitution, section by section, by the entire Congress. On the morning of the 18th, elections were held and Hiram U1AW was elected international president, Gerald G2NM, international vice-president, Jean F8GO and Frank Z4AA councillors-at-large and Kenneth U1BHW international secretary-treasurer.

With the election complete, the IARU was officially in business.

The new constitution was published in English, French and Esperanto. Why Esperanto, you ask? In the middle of 1924, the ARRL adopted Esperanto as its official auxiliary language. According to Clinton B. DeSoto, W1CBD, author of a fabulous book "Two Hundred Meters And Down - The Story of Amateur Radio", that might have been the highest official recognition that language ever received.

IARU President Tim Ellam, VE6SH

Credit to Clinton for much of the time line and wording I've shared here. I'll leave you with one final quote from his book.

Clinton W1CBD writes: "One day amateur television is bound to come, however remote though that day may be. It is, indubitably, inevitable that one day amateurs will be able to see each other, as well as talk with each other; and when that day comes the development of amateur radio as a social institution will have taken another great step forward - at least according to present standards. But by then the standards will have changed, and amateurs will have something more to work toward, and the ultimate will still not have arrived. There are always new goals, new horizons. May it fall to amateur radio to march many steps toward the goal of complete knowledge ere its footprints are lost in the sands of time!"

~ I'm Onno VK6FLAB

Reg Natarajan

I got a reply from ISED to my inquiry about Echolink. My inquiry was motivated by a post in this group a few days ago asking about some other legal subtleties with Echolink. I was interested in two basic points and ISFD answered both definitively:

1. You do not need an Advanced Certificate to use Echolink on any Canadian-homed Echolink station (usually a repeater).
2. When communicating through a Canadian-homed Echolink station, you do not need to modify your call sign in any way from how you would use it if you were on Canadian soil. All rules apply as though you were on Canadian soil.

ISED's position is that Amateur Radio rules only apply to the RF trip from the Echolink station (usually a repeater) to whatever amateur station(s) it is communicating with. They are not interested in the Internet trip that occurs between your Smartphone running the Echolink app and the repeater. You are to act as though you are operating a normal amateur radio on Canadian soil.

No-Ham Recipes

Cheddar Cheese Biscuits

by DOROTHY HRISCHENKO VE7HUO

Try these biscuits at breakfast with eggs and sausage or for dinner without the addition of honey or maple syrup. This recipe makes 9 large biscuits.

Preheat oven to 450F (230C or a hot oven)

- 2 cups (500 ml) whole wheat flour
- 4 teaspoons (20 ml) baking powder
- 1 tablespoon (15 ml) raw sugar
- 1½ cups (375 ml) shredded cheddar cheese
- ½ teaspoon (2.5 ml) sea salt
- ½ cup (125 ml) shortening
- 1 egg
- ¾ cup (200 ml) milk

In a large bowl, stir together flour, baking powder, sugar and salt. Cut in shortening finely; add cheese and stir in.

Beat egg and milk together. Add to flour mixture, mixing lightly with a fork until just combined.

On a floured board, knead dough gently 15 times. Roll to ¾ inch (1.9 cm) thickness.

Cut with floured 3 inch (7.6 cm) round cutter; place on ungreased cookie sheet. Bake for 12 to 14 minutes. Serve warm with butter and honey or maple syrup.

Back to Basics

From The Canadian Basic Question Bank

Overmodulation

A source of interference and distortion

John Schouten VE7TI has been teaching amateur radio courses for over 20 years, and is the Course Coordinator for Surrey Amateur Radio Communications

One technical issue that can affect the quality of Amateur Radio communications is overmodulation. This 'Back to Basics' delves into the causes, effects, and solutions to overmodulation in amateur radio transmitters.

The Canadian Basic Question Bank and our course frequently mentions overmodulation. For example:

B-3-12-1 What may happen if an SSB transmitter is operated with the microphone gain set too high?

A. It may cause digital interference to computer equipment

B. It may cause splatter interference to other stations operating near its frequency

C. It may cause interference to other stations operating on a higher frequency band

D. It may cause atmospheric interference in the air around the antenna

And

B-3-13-7 What is the result of over-deviation in an FM transmitter?

A. Poor carrier suppression

B. Out-of-channel emissions

C. Increased transmitter power

D. Increased transmitter range

And

B-3-13-3 What can you do if you are told your FM hand-held or mobile transceiver is overdeviating?

A. Talk farther away from the microphone

B. Talk louder into the microphone

C. Let the transceiver cool off

D. Change to a higher power level

What is modulation?

At the transmitter, modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a separate signal called the modulation signal. The modulating component of the radio signal typically contains information to be transmitted. This may be your voice or digital information. When you tune your receiver, you are tuning to the carrier frequency. The receiver circuits then extract the useful information in a process called demodulation.

In AM the signal is modulated by varying the amplitude of the carrier. In FM the modulation varies the frequency of the carrier. In FM, the same type of negative effects occur but the effect is called overdeviation. When it occurs, it causes a frequency-modulated radio signal to exceed the specified frequency excursion from the rest frequency.

What is Overmodulation?

Overmodulation occurs when the modulation index exceeds the maximum limit, causing the carrier wave to distort. In simpler terms, it's like speaking so loudly into a microphone that the sound becomes distorted. For amplitude modulation (AM) used in radio transmissions, it means the amplitude of the modulating signal is too high, which can lead to several problems listed below.

Causes of Overmodulation

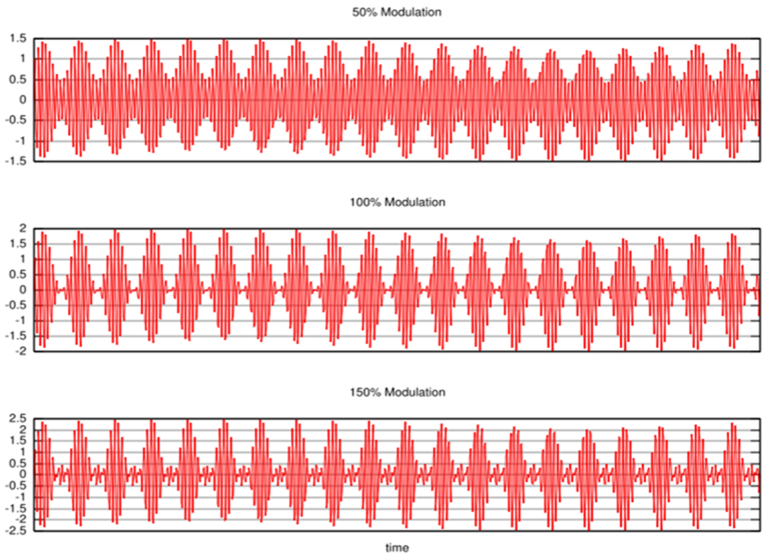
The primary cause of overmodulation is setting the audio gain too high or having an excessively loud input signal. This can happen due to operator error or equipment malfunction. Other causes include:

- Incorrectly adjusted equipment, for example too much microphone gain.
- Failure to observe proper operating procedures, for example talking too loudly
- Technical faults in the transmitter's modulation circuitry

Effects of Overmodulation

The effects of overmodulation are detrimental to both the transmitter and the quality of the communication:

- Signal Distortion: The most immediate effect is the distortion of the transmitted signal, making it difficult for receivers to interpret the message clearly.
- Interference: Overmodulated signals can bleed into adjacent frequencies, causing interference with other communications, known as "splatter".



Amplitude modulation at 50, 100, and overmodulation at 150%

- Reduced Range: A distorted signal can have a reduced effective range, as the power is spread across a wider bandwidth rather than focused on the intended frequency.
- Equipment Stress: Overmodulation can stress the transmitter's components, potentially leading to premature wear or failure.

Solutions to Overmodulation

Addressing overmodulation involves both preventive measures and corrective actions:

Proper mic procedure: Speak in a normal voice. The most frequent cause of overmodulation and overdeviation is excessive volume into the microphone.

Proper Calibration: Most modern transceivers have circuitry that controls overmodulation. Regularly adjust the transmitter to ensure modulation levels are within acceptable limits.

Monitoring Tools: Utilize modulation monitors and spectrum analyzers to observe the transmitted signal and make adjustments as necessary.

Equipment Maintenance: Perform routine checks and maintenance on equipment to prevent technical faults.

Operator Training: Educate operators on the importance of setting correct audio levels and recognizing signs of overmodulation.

Use of Limiters: If necessary, implement audio limiters in the signal chain to prevent the audio level from exceeding a certain threshold.

Overmodulation is a technical issue that can significantly impact the quality and effectiveness of amateur radio communications. By understanding its causes, effects, and solutions, operators can ensure clear and efficient transmissions.

As the amateur radio community continues to grow, maintaining high standards of transmission quality is essential for the hobby's ongoing success and enjoyment.

The answers to our sample questions:

B-3-12-1 What may happen if an SSB transmitter is operated with the microphone gain set too high?

B. It may cause splatter interference to other stations operating near its frequency

Explanation: The key words MICROPHONE GAIN SET TOO HIGH. This leads to 'overmodulation' evidenced by distorted speech plus using excessive bandwidth on the air (splatter) which interferes with stations using adjacent frequencies ('out-of-channel emissions').

And

B-3-13-7 What is the result of overdeviation in an FM transmitter?

B. Out-of-channel emissions

Explanation: 'Overdeviation (FM)' or 'Overmodulation (AM, SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').

And

B-3-13-3 What can you do if you are told your FM hand-held or mobile transceiver is overdeviating?

A. Talk farther away from the microphone

Explanation: key word: OVERDEVIATION. 'Overdeviation (FM)' or 'Overmodulation (AM, SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').

There are several Internet sites that can provide additional information. One technical paper that provides a thorough analysis is Modulation, Overmodulation, and Occupied Bandwidth

~ John VE7TI

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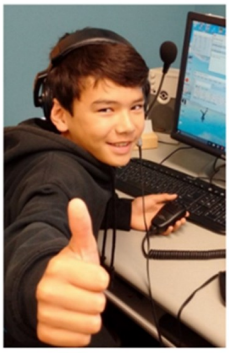

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- Use a radio, computer, smartphone or tablet for free worldwide voice and digital communications
- Participate in 'Radio Sports' like Contesting and Hidden Transmitter Hunts
- Practice an exciting hobby or start a career opportunity

City of Surrey
separ
Surrey Emergency Program Amateur Radio
https://separ.ca/

SARC
Surrey Amateur Radio Communications
http://ve7sar.net

New VHF beacon in Lynn Valley

Seeking high-precision signal reports from afar

by HALDEN FIELD VE7UTS

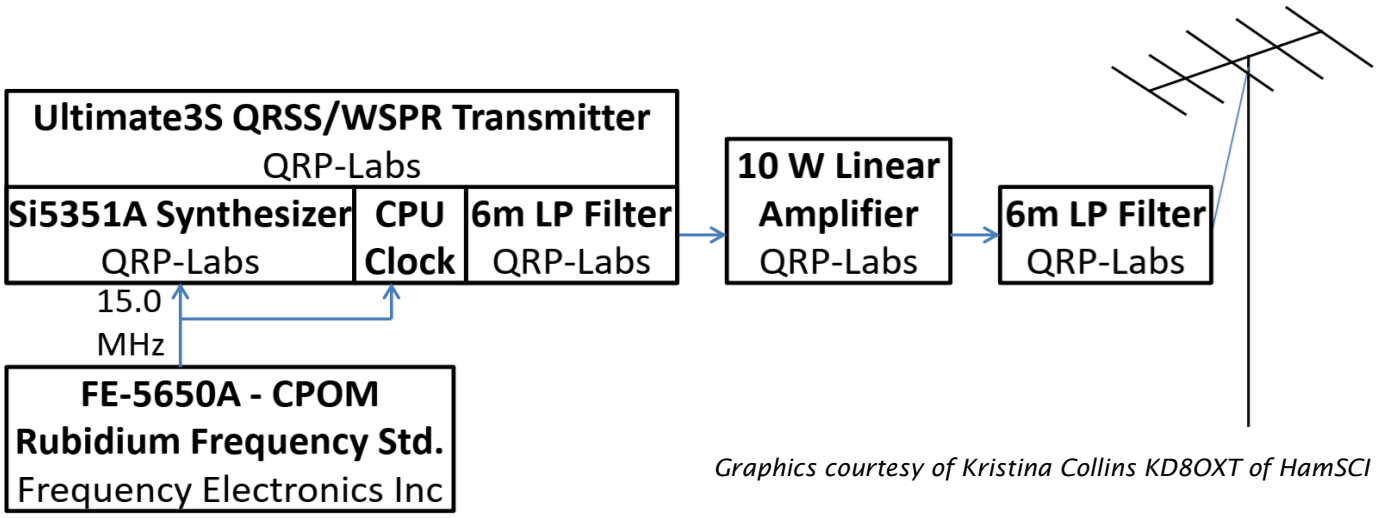
Since early April, VE7UTS has been beaconing on the common 6m WSPR frequency along with several other 6m beacons throughout the world.

I was fortunate to see a presentation by Kristina Collins, KD8OXT, of Case Western Reserve University at WWV's 100th birthday party just north of Fort Collins, Colorado in October, 2019. She clearly explained how changes in the altitude of the ionospheric refraction layer can cause shifts in received frequency, and how to observe them with inexpensive equipment. Wow! I couldn't wait to go home and try it out.

Automated reports of the WSPR beacon have arrived from southern California, Arizona, Colorado, and a few closer-in stations. Local reports have described "ghost" traces adjacent to the stable ones on the WSJT-x spectral display. Common speculation is that these may represent airplane reflections, as such reflections are consistent with the displayed frequency changes representing changing propagation path lengths due to the Doppler effect that would occur involving airplanes coming and going from Vancouver International Airport (YVR).

Six-meter openings are generally surprises. Mechanisms of propagation are well-known or understood by some hams, but not well-proven or quantified for specific propagation events. For example, a propagation path between here and Florida might be claimed to be double-hop sporadic-E or F2 depending on the intuition or experience of the ham making the claim and other observations regarding these ionospheric layers at the time. One of the purposes of this beacon is to evaluate whether Doppler frequency change or broadening observations might help determine the mechanism of a particular propagation event.

To that end, this beacon also sends a CW signal and a 1-minute carrier once every 6 minutes on 50.0565 MHz, the frequency previously used by VA7SIX. The transmitter's frequency is possibly a bit more stable than most, as it is derived from a rubidium (Rb) oscillator, also known as an "atomic clock". This means that if the frequency measured at the receive end varies, that variation isn't coming from the transmitter. If the receiver's circuitry is also governed by an ultra-stable oscillator such as Rb or Global Positioning

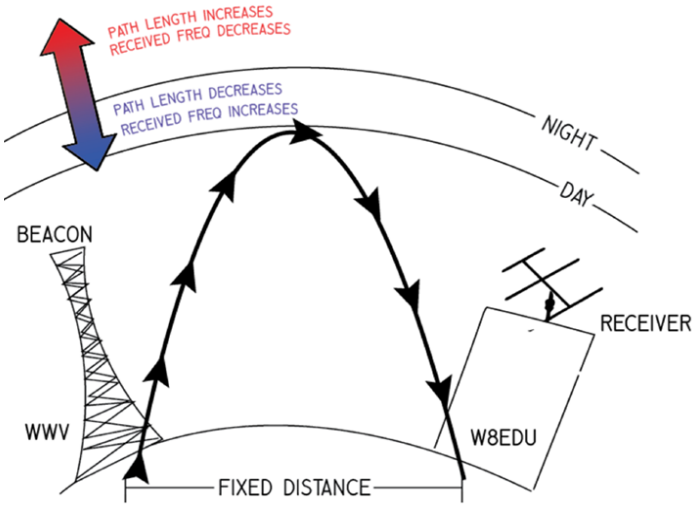


Graphics courtesy of Kristina Collins KD8OXT of HamSCI

The purpose of the WSPR beacon is to help members of the ham community know when propagation at 50 MHz is possible from Vancouver, BC to various places, and how strong such propagation is. The CW beacon seeks to provide data to help understand the nature of such propagation. Does it occur by refraction from the F2 layer of the ionosphere? Single or multiple refractions from the E layer? Ducting in the troposphere? Refraction from clouds of ions that don't comply with these models? Combinations of these mechanisms? When the WSPR signal is weak (< -5 dB S/N), the CW signal might be audible. When it's strong, one can characterize its frequency.

System Disciplined Oscillator (GPSDO), then the receiver can be presumed not guilty as well and the observed variation can be blamed on propagation path length changes. Halden seeks records of observations of such changes.

On lower frequencies, skip path length changes typically occur when the refraction region in the atmosphere rises or falls as ionization levels



change. Per the Doppler effect, this changes the perceived frequency at the receiver. But does this happen on 6 meters, too? Do signals bounce around in a duct of some sort before popping out of a hole in the atmosphere that happens to be above some ham's antenna? Do signals bounce off the sides of thunderclouds or volcano plumes? Which layer(s) do they bounce off of, anyway?

It is hoped that hams who are not in line-of-sight distance will listen for this carrier using an ultra-stable receiver, record the beat tone's trace on Spectrum Lab or similar software, and send a signal report.

The first such reports could help determine whether this technique could be informative or an utter waste of time, so to speak. More apparatus details are at

https://www.qrz.com/db/VE7UTS

~ Halden Field VE7UTS

JULY 2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
30 Contest: RAC Canada Day (SSB & CW)	1	2 1930 SEPAR Net 2000 SARC Net	3	4 2000 SARC GOTA Net	5	6 Coffee: 0700 Denny's 6850 King George Blvd., Surrey OTC Open 0930—Noon
7	8	9 1930 SEPAR Net 2000 SARC Net	10 SARC Meeting SARC Social Night at OTC 1900-2100	11 2000 SARC GOTA Net	12	13 Coffee: 0700 OTC Open 0930—Noon
14	15	16 1930 SEPAR Net 2000 SARC Net	17	18 2000 SARC GOTA Net	19	20 Coffee: 0700 OTC Open 0930—Noon Swap Meet Richmond ARC Contest: NA QSO Party (RTTY)
21 Contest: NA QSO Party (RTTY)	22	23 1930 SEPAR Net 2000 SARC Net	24	25 2000 SARC GOTA Net	26	27 Coffee: 0700 OTC Open 0930—Noon
28	29	30 1930 SEPAR Net 2000 SARC Net	31			

AUGUST 2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3 **Coffee:** 0700 Denny's 6850 King George Blvd., Surrey **OTC Open** 0930—Noon **Contest:** NA QSO Party (CW)
4 **Contest:** NA QSO Party (CW)	5 **BC DAY**	6 1930 SEPAR Net **2000 SARC Net**	7	8 **2000 SARC GOTA Net**	9	10 **Coffee:** 0700 **OTC Open** 0930—Noon **Contest:** WAE DX (CW)
11 **Contest:** WAE DX (CW)	12	13 1930 SEPAR Net **2000 SARC Net**	14 **SARC Meeting** SARC Social Night at OTC 1900-2100	15 **2000 SARC GOTA Net**	16	17 **Coffee:** 0700 **OTC Open** 0930—Noon **Contest:** NA QSO Party (SSB)
18 **Contest:** NA QSO Party (SSB)	19	20 1930 SEPAR Net **2000 SARC Net**	21	22 **2000 SARC GOTA Net**	23	24 **Coffee:** 0700 **OTC Open** 0930—Noon **POTA:** Group activation?
25	26	27 1930 SEPAR Net **2000 SARC Net**	28	29 **2000 SARC GOTA Net**	30	31 **Coffee:** 0700 **OTC Open** 0930—Noon

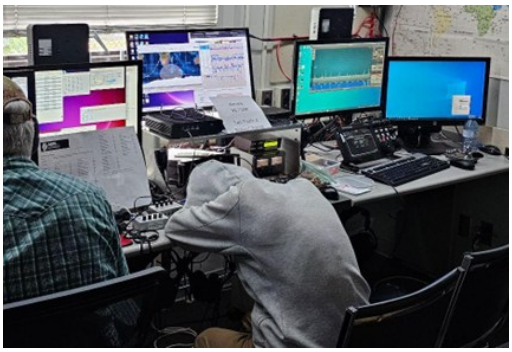
Field Day 2024

A smaller but successful effort

by ANDREW ELGIN VA7LGN

Field day 2024 has come and gone and it was an exciting and eventful weekend for all of us at SARC. We fielded a class 2F (emergency operation centre) setup this year with 2 stations located at our operational training centre, plus a GOTA (Get On The Air) and a VHF station located within our SEPAR (Surrey Emergency Program Amateur Radio) trailer parked outside. We also rolled out our 100+ foot "big foot" antenna mast trailer to give it a good test and shake out any bugs in advance of the RAC Canada Day contest.

We operated our two stations for the full 24 hours and managed to achieve 898 CW Contacts, and 755 SSB contacts (a total of 1653 contacts!). We also used our new satellite station to great success to attain 10 satellite contacts throughout the event.



Our satellite operator Adrian VA7YEP worked all through the night and could often be seen sleeping at the desk between passes *[photo below]*. Thank you for your efforts and 100 bonus points!

In addition to regular contesting work, we had a few excellent demonstrations. Firstly, Adrian provided our bonus for educational activity by explaining and demonstrating a successful satellite contact using his hand held arrow antenna. Second, Dino VE7NX brought out his home brew 10Ghz radio and made a contact with Scott VA7SC in a fantastic display of microwave radio ingenuity.

Field day also provided us with plenty of opportunity to engage with our community leaders. Surrey City Councillors Linda Annis and Mike Bose attended, and we welcomed Surrey Fire Service Battalion Chief Dennis Bull, and Training Officer Jerry Siggs. From the Surrey Police Service S/Sgt Brad Essex, the on-duty Watch Commander toured the facility. They were all very interested to see what Ham radio operators could offer the community.

As an interesting side-note, we also had 3 Amateur exams written (and passed) during the field day period. In fact two of these had only intended to learn more about SARC and schedule an exam but instead, both wrote their exams Saturday, and eagerly jumped on to our GOTA station to make their very first contacts. Congrats to everyone who passed.

Lastly we firmly enjoyed the opportunity to come together as a group and enjoy a barbecue together with dinner prepared by Ralph VA7UB and Nell VA7PE, Anton VE7SSD and Scott VE7HA as well as Heather Brodie. As the coordinator of the event I couldn't have been more thrilled with the outcome and thank everyone who came together to make it a success.

Special thanks to the following:

Field Day Committee

- Andrew Elgin VA7LGN
- John Schouten VE7TI
- Manvir Judge VA7BKI
- Adrian Mashhadi VA7YEP

Station Manager

- John Brodie VA7XB

GOTA Station Coordinator

- Mike Porisky VE7YEG

SARC Sponsor

- Steve McLean VE7SXM

SEPAR Sponsor

- Gord Kirk VA7GK

~ Andrew VA7**GOTA**

Station Coordinator

- Mike Porisky VE7YEG

SARC Sponsor

- Steve McLean VE7SXM

SEPAR Sponsor

- Gord Kirk VA7GK

~ Andrew VA7LGN
2024 Field Day Coordinator

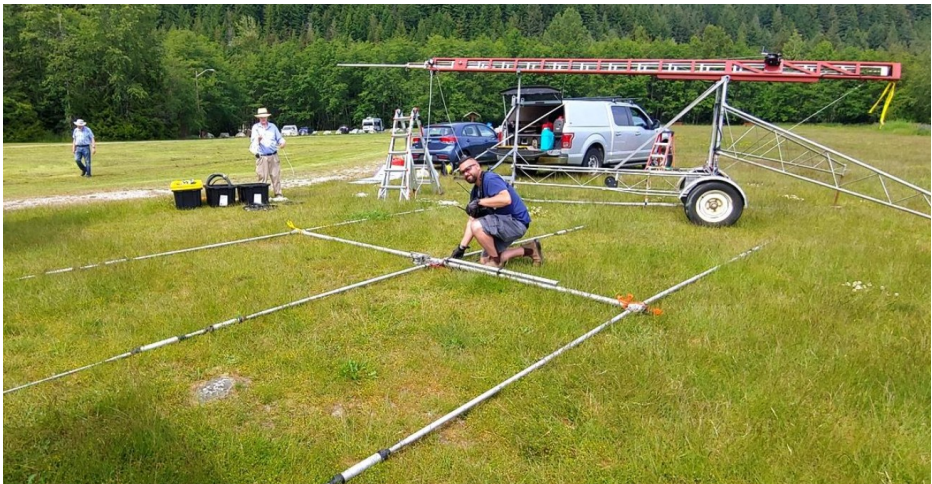
North Shore ARC Field Day '24

Field Day started at 11:30 am Friday at the District of North Vancouver Fire Training Hall. Our small team of NSARC members, including Joe (VE7JYH), Igor (VE7AXO), Heather (VE7HEA), Bill (VE7QC), Club President Allan (VE7BRD), and Fran (VE7JL), awaited my truck's towing capabilities to deliver the newly rebuilt radio tower up to Cypress. All gear had been diligently organized, tested, and packed into labeled bins the previous weekend, by Erica (VE7QER), Josh (VE7KXZ), Nick, Heather, Joe, Bob (VE7RPX), and Igor making for a quick load-up.

Josh (VE7KXZ), spent many hours welding and rebuilding the antenna trailer. The rebuild includes a new trailer tongue, height-adjustable leg, new brace arms to support the tower, two new ratcheting pulleys for cranking the tower upright and one for telescoping, all-new aircraft cables, new electrical connections, a 4-pin trailer connector, new LED turn signal and brake lights and 12V LED spot lights at the top portion of the first segment of the tower.

Joe and I headed up to Cypress in a convoy, with Joe providing a buffer behind me in the busy Friday traffic. We arrived at the Field Day site located at Cypress Park picnic area around 1:30 pm and found the bollards had not been unlocked yet. Soon after, Janice (VA7JMO) and the NS1 command vehicle, graciously lent to us by the North Shore Search and Rescue and driven up by NSR member Peter Haigh (VE7PGH), arrived. A call was needed to be made to Parks as it seemed they had forgotten about us. Thirty minutes later, we had access to the field and began setup, prioritizing shade due to blue skies and direct sunlight.

At the base of our antenna, about 20 feet off the ground, we hoisted up a dipole for 40/80 meters with an SWR of 1.1 on 40m and about 2.5 SWR on 80m. We considered getting more height on the dipole to improve the SWR on 80m but decided to proceed given the recent sunspot activity and favourable propagation on other bands. Next up was the club's Tri-Band Yagi (10m, 15m, and 20m) with SWRs of 1.1, 1.5, and 1.1, respectively. Atop the tower, we placed a vertical VHF/UHF Comet CX-33 lent to us by Josh, along with a custom-hemmed Canadian flag.



Night shift security included Wayne (VE7YZK) and his family, and myself. Other than highwinds rocking me to sleep in the command vehicle, the night was uneventful but we did get to witness a clouded strawberry moon over the Vancouver city horizon.

Saturday morning at 8:30 am, Joe (VE7JYH) brought breakfast and coffee. About 30 minutes later, Halden arrived with three 95W solar panels to charge a box of four 12.8V LiFePO4 batteries configured in parallel for 60Ah of solar-charged power, which we ran directly to the radios. Nick (VE7NRM) arrived and promptly started configuring N1MM and the radio.

Bill (VE7QC) dusted off the NSEM Pelican packet kit (VE7EMP) and set it up in the command vehicle. Messages were successfully received by VE7NSR in the NSARC radio room.

At 11:00 am sharp, the radio exploded with voices from all over North America. We stumbled over the start line with a few technical issues that Halden and I troubleshooted, but we made our first contact at 11:06 am.

~ Adam Kriz VA7KRZ

Hi from Kamloops...

I did a 1E Field Day this year… QRP using my Elecraft K2-10 and a SLA battery that lasted for all 215 contacts hi hi. I had a couple of days of sunny Wx to put a decent charge on the battery using a 10 watt Coleman solar panel that I bought from Can Tire a few years ago. I use Anderson Powerpole connections (direct replacements through Amazon actually). I have a connector on the solar panel cable; a 1 amp diode in series as an extra measure.

This year I stayed up most of the night, with a few scheduled sleep breaks, to work 40M. The band was in great shape… quiet with good propagation. Some stations on the Eastern seaboard heard me. Generally, Illinois is kind of the eastern limit for my QRP signal being heard on 40M from here. I don't have an 80M antenna up right now since I don't do the CW traffic net anymore.

I just had three hundred bonus points but that was OK by me. I was pretty much done-in by 8 AM our time on Sunday morning so I shut down my station then. Propagation to my QTH wasn't as good for 20M.

~ John VE7NI

Social Reminder

The Saturday weekly social gathering is once again 'on' at the Denny's Restaurant, 6850 King George Blvd., Surrey BC from 07:30—09:30. All are invited. Afterwards, we will host workshops and will be available to invigilate Amateur Radio exams at the OTC, 5756—142 Street, Surrey from 10-noon.

Bring your ham issues, our Elmers will try to help you sort them out.

The Contest Contender

RAC Canada Day

We worked the globe

by JOHN BRODIE VA7XB

JOHN BRODIE VA7XB reporting on SARC's contesting efforts.

Again this year, SARC was honoured to represent Radio Amateurs of Canada who granted our use of the VE7RAC callsign for the RAC Canada Day contest.

The roster of operators was: Mike VE7YEG, Steve VE7SXM, Sheldon VA7XH, John VE7TI, Larry VE7LXB, Jeanne VA7QD on SSB, with Les VA7OM, Slawa VE7LWW, Dino VE7NX and John VA7XB on CW.

Equipment comprised two IC-7610 radios each equipped with 1kw amplifier, both outputs through our 80-40m diplexer or 10-15-20m triplexer and bandpass filters.

The 100+ ft bigfoot tower with TH7 tribander on top was already in place from Field Day 10 days earlier but on this occasion, we elected to connect one end of the 80-40 wire antenna to the tower thus raising it to ~80 ft, because during FD with the wire in its normal, lower position, the 80 and 40m performance was poor.

In previous years we experienced interference between stations when on 80 and 40m. We hoped it would be different this time, and raising the wire antenna away from the building was anticipated to benefit propagation and reduce mutual interference. In fact, minimal interference was experienced, other than a PC crash which occurred 3 times on the 20m PC when the CW station was on 40m and 80m.

All the daytime action was on 20m and 15m, as 10m was virtually dead throughout the contest. At night, 20m stayed open until 10 pm when it too died. There was minimal activity on 80m, so 20m and 40m were the productive nighttime bands.

Despite poor propagation conditions, the team did work a considerable amount of DX, the most notable contacts being ZS1C in South Africa, plus many stations in Europe, South America and Oceania.

Now we will take a break from contesting during July and August, while good weather and outdoor activities beckon. See you in the Fall.

~ John VA7XB

Left: Les VA7OM, Above clockwise: Dino VE7NX, John VA7XB, our 'BigFoot' tower and Jeanne VA7QD.

SARC Vancouver Island Chapter meeting at the Fanny Bay Inn, near Courtenay BC, 27 June 2024.

John MacFarlane VA7PX, Kevin VE7ZD, Derek VE7VPG, John VA7XB and Heather.

May 2024

SARC General Meeting minutes

May 8, 2024

Recording Secretary JEREMY MORSE VE7TMY

SARC General Meeting Minutes 24.05.08

Attendees: 15 plus 2 remote via Zoom

Start Time: 7:03pm

Location: Surrey Fire Training Centre

Welcome

- Welcome by Steve McLean VE7SXM

Presentation

- Scheduled Presentation (Robert Frey WA6EZV) on "Radio-Orienteering" (aka "Foxhunting")

Announcements

- Foxhunt May 11, 2024
- SARC AGM June 12
- Saturday Breakfast and OTC Open House

Committee Reports

- Financial Report (Scott VA7HA absent)
- Nets (Reg VA7ZEB) - no issues

SEPAR/OTC (Gord VA7GK)

- OTC is being cleaned up by Search & Rescue. A soft spot on the walkway/ramp will be repaired by SFS

Membership (John VA7XB)

- Unchanged at 141 members
- Reminders will be sent shortly re dues

Contests (John VA7XB)

- May 25 CQ WW WPX Contest (CW) – looking for operators
- FD June 22-23 (SSB & CW) – Looking for operators
- July 1 Canada Day (SSB & CW) – using VE7RAC callsign

- RCAF 100 Years: The VE7RCAF event is over and Fred VE7IO is gathering stats and receiving about 5-6 (paid) QSL cards per day. iCOM is sponsoring the cards and we expect a proof in the next day or two and a printed stack a week later. It looks like our total QSO's are about 1,800.

Repeaters (Steve VE7SXM) - no issues

Ham Class (John VE7TI absent)

- Last Spring session has taken place and exams start next week
- The fall course could be delayed until late September

Communicator (John VE7TI absent)

- The Communicator is now also on a site called Calameo: (https://www.calameo.com/), where it is read much like a page-flip magazine with search and other capabilities. Already almost a thousand views there despite a recent upload and very little promotion. Plus there are already a couple of thousand views in the regular PDF format on Google Drive.

Old Business

Project Group (John VA7XB)

- Satellite items ordered are expected this week
- We have a few completed CW decoders for sale. Also a couple of CW kits which were reprogrammed or repaired by Dino to be picked up

OTC Projects (Gord VA7GK)

- SEPAR Trailer Maintenance and BCWARN upgrades are ongoing. Possible service/tires may be required this year.
- Maple Ridge Swap Meet May 4th (John VA7XB). We took in $222 and cleared some space in the container. Thanks to Doug and Gord for their assistance at the table, also to Dino for help with pre-sorting and pricing

Run Surrey Run (John TI VE7TI absent)

- Four of our members volunteered for the SunRun and the they donated $100 to SARC/SEPAR as a token of appreciation.

Field Day 2024 (Andrew VA7LGN

- Connect with Andrew if you wish to assist andrew.elgin@gmail.com
- Running Class 2F (2 stations + GOTA from SEPAR trailer)
- Looking for new hams to help operate GOTA station.
- 2m/50m station, Bigfoot 105ft tower and yagi
- Alternate power, solar, satellite contact
- Invitations have been sent to local politicians and emergency services
- Ralph/Nell will be organizing with food

New and Other Business - none

Adjournment at 8:54pm

~ Minutes prepared by Jeremy Morse VE7TMY

The presentation (Robert Frey WA6EZV) on "Radio-Orienteering" (aka "Foxhunting") from the May 8 SARC General Meeting may be viewed on YouTube: https://youtu.be/d2loVp4ToEY

June
2024

SARC Annual General Meeting minutes

June 12, 2024

Recording Secretary MIKE PORISKY

SARC Annual General Meeting Minutes
24.06.12

Attendees: Refer to the attendance sign-in sheet

Start Time: 7:07pm

Location: Surrey Fire Training Centre

Welcome & Call to Order:

Steve McLean VE7SXM: The 2024 Annual General Meeting of the Surrey Amateur Radio Communications Society was called to order at 19:07 by President Steve McLean. Steve explained that tonight's event will be broken into 2 meetings; the regular monthly meeting will follow the Annual General meeting. Steve presented the agenda on screen.

Announcements:

- Steve announced the passing of 3 club members; Marion Orsetti, Erich Burr and Kjeld Frederiksen.
- John S gave a tribute to Marion. No information was available yet regarding Marion's service.
- It was noted that Erich's celebration of life might take place in September.
- Steve called for a moment of silence to remember those we lost.

Calculation of Quorum: As of June 12, there were 106 paid members setting the quorum at 26. There are 36 members and/or proxies present at the meeting thereby exceeding the required quorum.

- Steve made a motion to approve the agenda – Gord K seconded, carried.

Approval of Previous Year's Minutes: Jeremy M prepared the minutes of the 2023 meeting and they were distributed in the SARC Communicator. Shawn moved that we approve last year's minutes, seconded by Doug, carried.

Presentation and Approval of Financial Statements:

- Scott reviewed the financial status of the Society including the Balance Sheet and Profit & Loss
- Three changes were made in the past year that benefited SARC: the bank account was switched from HSBC to Capital Savings, it was set up to receive e-transfer payments and a portion of cash on hand was invested in a GIC.
- Amounts involving grants, donations, interest and income from courses were discussed in more detail. A suggestion was made by Sheldon to consider multiple, smaller GICs.
- The major differences between last years and this year's account dollars were explained.
- Daryl asked about the interest rate that the society is getting on the account.
- Kapila asked if the donation and expense numbers are related – Steve explained that they were.
- Scott asked that the financial report be accepted, Gord K seconded, carried.

Committee Reports:

- Steve reviewed this year's successful SARC projects – BC Warn configuration (Concord Tower), Firehall 1 clean-up, Web site page changes, satellite controller installation, and other changes/cleanup at the OTC.
- Reminder that members meet at Dennys on Saturday morning starting at approximately 7:00 am – all are welcome (8650 King George Blvd.).
- John S presented an update on Run-Surry-Run taking place on September 8th. This year's run will be competitive. Vehicles will be required to give way to the runners. The SEPAR trailer will be located in the park.
- Steve displayed a signal distribution map highlighting the success that has been achieved with the WSPR project.

SEPAR – Gord K

- Reviewed SEPAR activities, maintenance items completed, changes made to the SEPAR trailer.
- Re-affirmed good relationship with the Firehalls and City Councilor Linda Annis will be attending Field Day.
- Reminder that SEPAR holds a weekly net, Tuesdays at 19:30 to practice radio procedures.
- Gord indicated that he is working with contractors for the building and grounds used during Field Day.
- Gord & Scott participated in an event that co-ordinate frequency-sharing between other jurisdictions.

Membership – John B

- Last years membership pending additional renewals is 142
- Paid membership as of tonight's meeting is 106
- There are approximately 200 provisional memberships – notice going out to encourage renewals.

Projects – John B

- Three projects were recently completed: Morse Tutor, WSPR and Satellite hardware installation.
- Adrian M has agreed to take on the position of Satellite Station Manager.
- Thanks to Dino for all his work organizing the projects this year.
- Dino G passed on to the membership some of the upcoming projects including NTP Clock Server, 10 GHz Beacon, moon-bounce testing, and possibly a 10 GHZ station activation for Field Day.

Nets - Reg N

- All nets are "going well" – several new net controllers were recently added.
- Upcoming vacations will require re-scheduling of NCO, reminder to check the scheduling calendar.
- Reg thanked Wayne for managing the GOTA net. And Wayne thanked all the experienced contributors that have participated in the GOTA net, helping make it a success. Wayne encouraged all members to participate (Thursdays at 8 PM).

Ham Classes - John S

- New Ham courses take place every 3 months although the summer Ham class will be cancelled in exchange for the High School Summer School project that John S, Gord K and Adam D are working on. Activities include Foxhunt and satellite communications in addition to the Ham radio course.
- More out-of-town students are signing up to SARC's classes these days.
- The average exam score is in the high 80s.
- QUESTION: Reg asked 'what the timeline was before the new Advanced Exam questions were implemented?' John S answered that the questions should make an appearance late this year. Reg also pointed out that members could sign into his website to obtain training material for their advanced certification. The previous class saw

Communicator - John S

- The communicator magazine has upwards of 20,000 downloads each issued.
- There is a new web service for storing and reading PDF files of the Communicator magazine. The previous 2 years of the magazine have been uploaded. https://www.calameo.com/search#search-sarc communicator/books
- Thanks to John B, Kevin M, Doug J and others for submitting articles for the magazine.
- 5 participants passed the advanced exam.

Repeaters - Steve M

- All repeaters are operating normally.
- Question: Adrian asked 'how long is the timeout before EchoLink auto-drops the connection if there is no transmission?' The answer will be addressed offline.
- Question: 'Can a receiver tone be added to prevent interference from another repeater located in Washington?' This will be looked into at a later time.

Election of Directors

- Gord K assumed the chairperson's role for the election process.
- A listing of all Director positions was displayed onscreen, highlighting the positions being elected tonight.
- Gord explained the rules around the voting process. Scrutineers (Reg & Shawn) were assigned.
- Four directors were required, 3 were running again and 1 position was available. Andrew Elgin stated that he was willing to run for the position and his name was added to the ticket along with the directors running again.
- Gord requested nominations from the floor 3 times. No additional nominations were received.
- Gord proposed that the Director positions be filled by acclamation. The 4 positions were filled by those appearing on the ticket.

Adjournment:

- Steve moved to adjourn the Annual General Meeting
- Seconded by Adrian, carried.
- Annual General Meeting adjourned

~ Minutes prepared by Mike Porisky

June
2024

SARC General Meeting minutes

June 12, 2024

Recording Secretary MIKE PORISKY

SARC General Meeting Minutes 24.06.12

Attendees: Refer to the attendance sign-in sheet

Start Time: 7:07pm

Location: Surrey Fire Training Centre

Welcome & Call to Order

Steve McLean VE7SXM: The Monthly Meeting of the Surrey Amateur Radio Communications Society was called to order at 20:24 by President Steve McLean. Steve presented the agenda on screen.

Committee Reports

Contesting

- John B. reviewed the 2 upcoming contests: (1) Field Day will take place June 22 starting at 11 am and running for 24 hours. (More about Field Day shown below.) Also, Canada Day contest will take place July 1 with SARC using the RAC call sign.

General

- Steve M. mentioned that Richmond's swap meet is taking place July 20 and asked if SARC should get a table. It was decided that there were not enough items to warrant a table. Gord indicated that SEPAR may get an invite to display the trailer again this year, which could include a free table.
- Scott stated that New Westminster requested help during their fireworks event, SARC members may be invited to assist.
- Andrew E. stated that White Rock may request assistance from SARC members for their Candle Torch parade taking place on the August long weekend. We will wait for more information from the White Rock Radio Club.

Field Day

- Andrew E.: Site Plan – reviewed antenna layout at the OTC, NVIS pending, displayed operator list, SEPAR trailer configuration (GOTA station pending), No plans for digital station.
- Andrew reviewed Field Day objectives/ synopsis (Testing of emergency operations).
- Each phase of the process was reviewed:
- Setup will take place Friday starting around noon, SEPAR trailer will arrive Saturday morning, Senior operator will assume Station Manager position, Safety Plan will be posted with contacts listed, Frequency used by planning group will be 146.55 simplex, Adrian M. will demo Sat comm between 11:00-13:00, Dinner at 17:30, Teardown after dinner.
- Equipment: Three ICOM IC-7610 radio's and one FLEX, an information table will be set up for distributing pamphlets and handouts, and an activity table will be available for kids project.
- Dinner (provided by Nell W. & Ralph W.) starting at 17:30, planning for head count of 40
- Volunteers Needed: Setup starting at 1 PM Friday, teardown starting at 11:00 on Sunday, cables need to be tested.
- GOTA: More new operators are needed to operate the GOTA station (licensed within the past new or inactive), GOTA station may be cancelled if operators & coaches are not available.
- Questions: John B. will check for available Wave files and send out reminder, Adrian M. will document satellite passes in advance, Gord K. reminded members that parking at the OTC will be limited and recommended parking in the lot on the east side.

Meeting Adjournment:

Steve M. made a motion to adjourn the meeting, seconded by Andrew E., carried

- Meeting adjourned at: 9:01pm

~ Minutes prepared by Mike Porisky

Your SARC 2024-2025 Directors

SEPAR

Another Field Day Success

by GORD KIRK VA7GK

Field Day 2024 is now behind us, and it was a great success. One of the purposes of the annual event is treating it as an exercise to run emergency communications for 24 hours. This involves the planning, set up, actual operation as well as the demobilization at the end.

Whether the event is being held in an outdoor temporary setting or at an existing EOC (Radio Room) there are so many different areas to utilize for the contest points.

Once again, this year we chose to activate at the SEPAR/SARC Operations and Training Center (OTC). This is a shared space with the South Fraser Search and Rescue Team that the city provides to our respective volunteer organizations for the purposes of providing these emergency programs.

We moved “Bigfoot” our portable 110 foot antenna trailer from its covered parking into position on the grass next to the building and set it up. This unit has a beam, and rotator along with a propane generator and all the required coax to set up anywhere we can find a level spot. We have worked with the city, and they have prepositioned 3 large concrete blocks to use as anchor points for the tower guy ropes. This location does allow us to have a splace and plan that we can move onto and set up whenever it is needed.

SEPAR does have a radio room at Fire Hall One for EOC communications. Our OTC will allow a remote radio relay point to be staffed and operated

Gord Kirk VA7GK is a SARC Director and the SEPAR Coordinator

with minimal impact around a very busy operational fire hall. The OTC is the extension of the Fire Hall 1 radio room allowing for two HF towers and a dipole in the nearby trees.

We expanded to add another HF station outside of the radio room to provide another HF radio station to operate. In this shared room we have added a junction box on the wall to hook up coax etc. to help keep cables off the floors. This is also available during our weekly drop-in to have space to hook up and test radios etc.

Outside in the parking lot we again set up the SEPAR trailer and public display tables. The SEPAR trailer has an HF Station and two VHF/UHF spots. This year ICOM Canada allowed us to borrow an IC-7610 radio for the GOTA station. We set it up and those dropping-in were able to try to make a contact or two. Again, during set up we identified a couple of areas to improve the trailers operation and also areas to improve / fix. Some missing items were identified to be purchased to help ensure the trailer is fully equipped for future deployment.

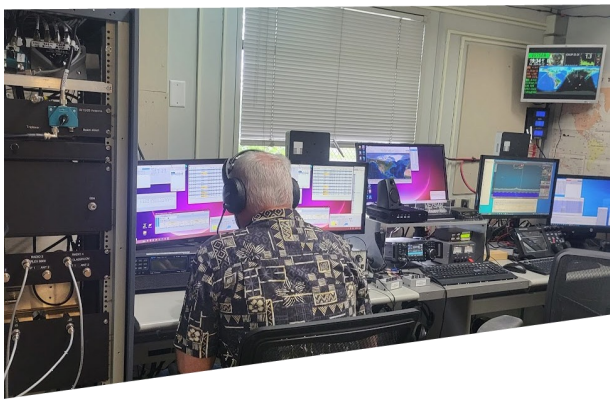
Many of the projects worked on last year (see previous SEPAR Updates in the Communicator) worked very well and made our set up so much easier and safer.

Speaking of safety we did have a safety briefing by the Field Day Coordinator Andrew VA7LGN. He led the field day planning team and organized a great event. During his briefing he made sure everyone signed in (also making provisions for guests to sign in), identified the muster point, had emergency instruction if help was needed and posted these throughout the area, in the radio room, on the trailer etc. The City does require a legal agreement and proof of insurance when we set up the tower. As part of the city's emergency program the Fire Department assisted us in getting the agreement looked after. They also worked with the City Council to Proclaim Amateur Radio Week in the city, recognizing the volunteers and their commitment to making a safer community.

Invitations were sent out and we had representatives from the City Council stop by, say hello, and tour of the event. We also had a representative from the Provincial Government's Emergency Management & Climate Readiness (EMCR) stop in. Our city is the location of one of the PREOC's (Provincial Regional Emergency Operation Center) so it will become a hub for communications in a regional emergency. Also, we had visitors from the Fire Department and from the city's new municipal Police Service stop in for a tour.

There were also visitors from the public, other radio clubs, and families who stopped in at various parts of the event. Those who came by around dinner time on Saturday were invited to join us for another great BBQ hosted by SARC and prepared by two of the SEPAR volunteers Nell and Ralph. During the BBQ several

commented on how important the times of just visiting, hanging out and laughing etc. are to make such an active group a success.



We had some firsts that will likely be covered in other articles, but in summary we saw our new satellite radios and antenna array in action, we had a 10 Ghz radio demonstration, and had two visitors inquire about licenses and sitting an exam. One of the club's examiners offered to have them write the exam immediately, if they wanted to try. They agreed and both passed. So, we immediately encouraged them to go out to the SEPAR trailer and "get on the air" which they both did. After this success we invited them to join us for dinner to celebrate.

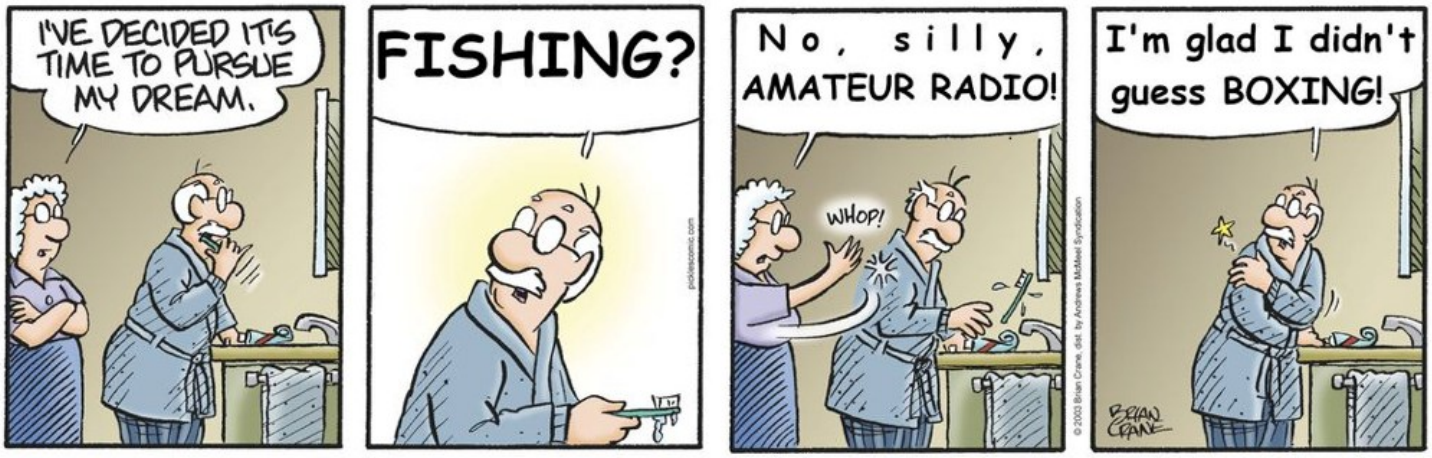
Overall, we had a great time. Many who came to operate may not realize that all the equipment setup, testing, repairs, and planning, including providing food and drink, are all part of an annual exercise to help our community be ready should a disaster occur.

A big thank you to everyone who helped with this year's event. Having such a great team of volunteers makes our volunteer SEPAR program a success.

If you would like more information on the Surrey Emergency Program, please reach out.

Please note our new email address below (SEPAR@ve7sar.net).

~ Gord Kirk VA7GK
SEPAR Coordinator
SEPAR@ve7sar.net



One of the reasons that amateur radio exists at all is to provide emergency communications. One of the bases of amateur radio is, "Recognition and enhancement of the value of the amateur service to the public as a voluntary non-commercial communication service, particularly with respect to providing emergency communications."

Amateur radio operators take this responsibility very seriously. Each year, many amateur radio operators step up to assist a number of "served agencies" with public service and emergency communications. This includes local events, such as helping out your town's emergency services, searches for a missing person; larger events, such as providing communications during a wildfire; and international events, such as helping international aid groups coordinate their efforts after a hurricane or tsunami.

Over the years much has been written describing that role. Here is a document that provides an excellent summary:

https://ia801303.us.archive.org/24/items/amateurradioemer00unse_0/amateurradioemer00unse_0.pdf

Surrey Emergency Program Amateur Radio

Regional Frequency Plan

Name	Frequency	Offset	CTCSS
VE7RSC (Primary Repeater)	147.360	+0.600	110.9
VE7RSC (Secondary Repeater)	443.775	+5.0	110.9
VE7RPT (Primary Regional Repeater)	146.940	-0.600	Optional 136.5 Rcve
Simplex 1	(VHF) 146.550		
Simplex 2	(VHF) 147.420		
Simplex 3	(UHF) 446.550		
Simplex 4	(UHF) 447.425		

Other frequencies in the Greater Vancouver area:

Primary:	Coquitlam/Abbotsford	146.430
Primary:	Inter-Municipal Group 3	146.445
Primary:	Vancouver; Mission; Sec. Coquitlam	146.460
Primary:	Kent-Mission; Sec. Richmond	146.475
Primary:	Inter-Municipal Group 2	146.490
Primary:	New West; Sec. Richmond	146.505
National	Calling / FM Simplex Group I	146.520
Primary:	North Shore; Port Coquitlam	146.535
Primary:	Bowen Island; Surrey	146.550
Intermunicipal Group 1 Coordination		146.565
Primary:	Lions Bay/Vancouver/Delta/Langley	146.580
Primary:	Port Moody; Sec: Burnaby	146.595
Secondary:	Vancouver/Surrey	147.420
Secondary:	Vancouver (UBC) / Maple Ridge	147.450
Primary:	White Rock/Chilliwack; Sec. No. Shore	147.480
Secondary:	Burnaby/Pitt Meadows	147.510
Primary:	Delta; Sec: Abbottsford	147.540
Primary:	Hope; Sec: Delta; ALSO EMBC	147.570

Reprint Policies

These are policies for reprints from The Communicator, a bi-monthly journal about amateur radio and other topics published by Surrey Amateur Radio Communications (SARC).

You may use articles authored by SARC members for your club newsletter or other amateur radio publication, provided that the purpose is non-commercial, you credit the author, and provide a link as follows: https://ve7sar.blogspot.com/search/label/SARC%20Communicator. If our article indicates it is from a source outside of SARC, we cannot transfer that right, and you must seek permission to re-publish from the original source. We appreciate being notified via email to communicator@ve7sar.net if one of our original articles has been re-printed elsewhere.

We welcome your comments and feedback

Please consider leaving a comment via email to communicator@ve7sar.net, or on our blog site https://ve7sar.blogspot.ca or, better yet, contact our authors directly, so they know someone is out there reading our publication.

Social Reminder

The Saturday weekly social gathering is once again 'on' at the Denny's Restaurant, 6850 King George Blvd., Surrey BC from 07:30—09:30. All are invited. Afterwards, we will host workshops and will be available to invigilate Amateur Radio exams at the OTC, 5756—142 Street, Surrey from 10-noon.

Bring your ham issues, our Elmers will try to help you sort them out.

SARC news…

Marion Elaine Orsetti

MARCH 21, 1937 – JUNE 8, 2024

As many senior SARC and SEPAR members will attest, Marion was a consummate hostess and enjoyed entertaining family and friends at their home.

After a lengthy illness, Marion passed peacefully at home surrounded by her family. Survived by her husband Fred VE7IO, sons, siblings, grandchildren and great-grandchildren. Marion grew up in Vancouver and went to Gladstone high school where she met her future husband Fred. Marion and Fred married in 1957 and enjoyed 67 years of a full and happy life together.

Marion and Fred enjoyed many years of trailering and in their later years would spend several months each year in the southern United States, particularly in the Quartzsite, AZ area.

Erich Hugh William Burr VA7EHB SK

AUGUST 4, 1958 – MAY 29, 2024

It is with deep sadness that we announce the passing of Erich Burr on May 29, 2024, at the age of 65. Born in Kitimat, BC, on August 4, 1958, Erich will be fondly remembered and deeply missed by his loving wife of 42 years, Lori, and their two daughters, Amanda, and Ashley.

Erich maintained a strong connection to his Kitimat roots but chose to make Vancouver his home in 1976. During his college years, he worked as a lifeguard and then at Expo86. Following his studies, Erich pursued a career as an electrician and dedicated 30 years to Telus.

Erich was a multi-passionate man who touched many lives with his diverse interests and talents. He was a devoted family man and a great friend to many. His passions included: working as a Reiki master, practicing as a hypnotherapist, traveling, especially enjoying cruises and scuba diving around North America, engaging with SARC weekly, and pursuing photography.

Erich's love for life and varied interests brought joy to everyone who knew him. His presence will be greatly missed, but his memory will live on in the hearts of those who were fortunate enough to know him.

A celebration of life to honor Erich will be held in mid-September.

Ham Leftovers...

A look at D-Day communications

The 80th anniversary of D-Day was last month, on June 6th but this item is worthwhile reading so we thought it should be included. Landing over 75,000 Americans and over 83,000 soldiers from the UK, plus a contingent from Charles DeGaul's Free French army, and controlling them as they pushed inland required a huge communications effort including 90,000 transmitters!.

This link will take you to an excellent article published by RadioWorld (www.radioworld.com). This article describes the huge effort required to ensure communications among the troops and their headquarters.

Hamclock on Windows

KF0IDT posted a video a while back showing that HamClock can be loaded on a Windows system. Since then a lot of people have commented that they have had problems getting it to load right. So, he has made a video going through the steps in real-time on how to load and configure Hamclock on both Windows 10 and 11, and it runs just fine. Hope you enjoy it!! https://youtu.be/0lmcpbnUAoI

New Zealand CW communications in 1939

Before modern radio broadcasting, the trails were being blazed both in public broadcast, but also critical links out of the local area. Here's a side-look back in time… in this 1939 Film: *New Zealand Shortwave Communications; Morse code* https://youtu.be/H-KUat5WEkU

Another easy to build WSPR beacon

This one hit Texas and Colorado from the North Sea on several bands, not bad with a fraction of a watt: https://hackaday.com/2024/06/14/a-super-simple-standalone-wspr-beacon/

Try radio astronomy?

There are many facets to being a radio hobbyist, but if you've ever had the urge to dabble in radio astronomy, check out "The Novice's Guide to Amateur Radio Astronomy," a presentation at the 2024 conference of the Society of Amateur Radio Astronomers. In that presentation Nathan Butts covers everything from why you should take up the hobby, how to set up a software defined radio (SDR) receiver, and how to repurpose old computers. This is just one of a series of videos recently posted from the conference – check out their channel to see them all. https://youtu.be/uz15GmR_aXc

We're QRT

It's Summer

Time to get active outside!

by JOHN SCHOUTEN VE7TI

John Schouten VE7TI is a Director with Surrey Amateur Radio Communications

With summer here it becomes harder to sit inside at a radio when the sun; blue skies; birds; and blossoming trees, shrubs and flowers are beckoning outside. Fortunately, the outdoors and ham radio make a superb combination, thanks to today's miniaturized and power-saving technology.

VHF/UHF FM handhelds (HTs) often provide the most available way of taking ham radio outdoors. An HT with a decent whip antenna (something rather better than the usual rubber ducky), an external microphone, and an ear bud can be used for "pedestrian mobile" radio, bringing the old expression "walkie-talkie" to life.

Alternatively, and with appropriate precautions to avoid collisions and other nasty mishaps, an HT and whip antenna can be secured to a bicycle for "bicycle mobile" radio, perhaps making use of VOX operation with a suitably compact one-sided headset. A blog that I follow, "Ham on a Bike", is written by Jim Williams N4JAW. His ham radio journey began while spending the Christmas holiday of 1956 at grandparents. Since going car-free several years ago, 99% of Jim's POTA activations are done by bicycle. "I call myself Ham on a Bike, and as a bike tourist it is nothing for me to load up my bike for a trip which includes ham radio to add to the adventure".

A suitable clamp can fasten a whip antenna to a park bench for portable, rather than mobile, operation, allowing the less energetic but peripatetic ham to enjoy the fresh air, sunshine, and sights and smells of spring in a local park, taken one bench at a time, moving from location to location as fancy dictates.

Even more fun for some of us, at least, is the opportunity to work some HF DX contacts while walking along the beach, following the

example of Peter Parker VK3YE (see Peter's YouTube channel at https://www.youtube.com/@vk3ye for some videos of beach pedestrian mobile HF SSB operation using his "Wadetenna"). HF pedestrian mobile operation makes use of highly compact and light-weight yet high performance QRP (low power, typically 4-5 Watts) transceivers such as the popular Yaesu FT-817 or the highly regarded Elecraft KX3. Even smaller and less expensive (but often lower power and definitely less flexible) rigs are available for pure CW operators.

For even more outdoors adventure, the physically fit ham can take part in the Summits on the Air (SOTA, http://www.sota.org.uk) program. SOTA operation is possible with either HF (and modest antennas) or VHF (with lightweight portable beam antennas) radios, and is a superb way to combine mountain hiking (or even technical climbing) with ham radio.

For hams not yet sufficiently fit to climb mountains, there is Parks on the Air (POTA, https://pota.app/#/), or Islands on the Air (IOTA, https://www.iota-world.org/). Both programs offers a fun and challenging alternative for HF operations from picturesque locations, no matter where you live.

More information is available on all of these outdoor activities on the internet by using search terms taken from the above descriptions. All are suitable for either solo or group activities, as your personality dictates. If you are ready to try it but are reluctant to go solo, let us know and we'll put you on a list to see if we can partner up some members.

A dozen members constructed our 5-band HF dipole project and I know many are anxious to try them out on a group field trip. We had a great POTA session last year organized by Dmitry VA7DVO. I'm sure we can arrange to do it again so, if you are interested in outdoor radio operations, whether VHF/UHF or HF, but would like more information, contact SARC, either at the end of any Tuesday night SARC net, or via email to communicator@ve7sar.net.

If enough members would like to take part in joint outdoor radio activities, an Outdoor Radio special interest group (similar to the groups for Contesting, Satellite, and CW groups) could be organized under the SARC umbrella to coordinate partnering and possibly group outings.

Hoping to work you outdoors, 73

~ John VE7TI

(with inspiration from Brett VE7GM—SK)

[above] Dmitry VA7DVO working HF from a POTA activation

[below] with son Alex at our 2023 group POTA workshop

SARC SOCIETY DIRECTORS 2022-2023

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SEPAR at ve7sar.net

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course at ve7sar.net

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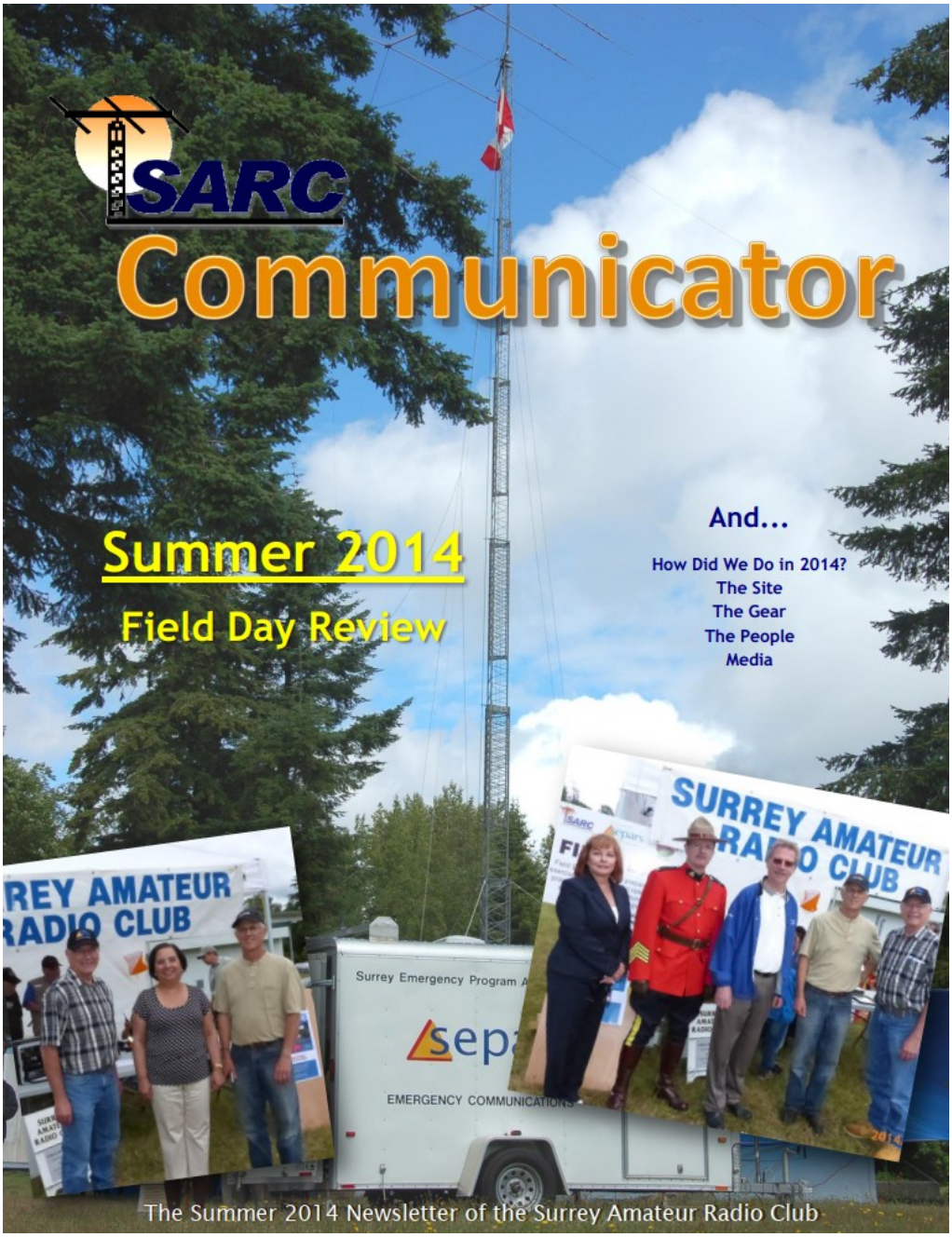
SARC NET MANAGER
Reg Natarajan VA7ZEB
net at ve7sar.net

A look back...

At The Communicator—August 2014



Past Communicators are available at:
https://ve7sar.blogspot.com/search/label/SARC%20Communicator
or search the complete Communicator contents & index at:
SARCindex

July and August

Have we mentioned its summer? We do not have regular meetings in July and August but we do gather socially on our regular meeting nights. Hopefully we will see you on both Wednesdays, July 10 and August 14 at the OTC, 5756 142 Street, Surrey. Of course we're also at the OTC most Saturday mornings from 09:30 until noon.

In September we will resume our regular meeting schedule and further details will be provided in the September-October Communicator.

SARC hosts an Amateur Radio net each Tuesday evening at 8 PM. Please tune in to the VE7RSC repeater at 147.360 MHz (+600 KHz) Tone=110.9, also accessible on IRLP node 1736 and Echolink node 496228.

On UHF we operate a repeater on 443.775MHz (+5Mhz) Tone=110.9 or IRLP Node 1737.

*We have a '**Get On The Air**' net directed at new hams on Thursday evenings at 8pm, on our 2m repeaters: North: 147.360MHz+ Tone=110.9Hz and South: 147.360MHz+ Tone=103.5Hz. Our SARC Elmers will be on hand to answer your questions.*

	SARC Net 20:00 Hrs
1st Tuesday Standby	Gary VA7GPR Reg VA7ZEB
2nd Tuesday Standby	Andrew VA7LGN Sheldon VA7XNL
3rd Tuesday Standby	Larry Bloom VE7LXB REG VA7ZEB
4th Tuesday Standby	Kapila VE7KGK John VA7XB
5th Tuesday Standby	Reg VA7ZEB Vacant
Want a turn at Net Control? Contact the SARC Net Manager	

Down The Log…

SARC Monthly Meetings

2nd Wed. (Sept-Jun)
1900 hrs at the Surrey Fire Service Training Centre, 14923 - 64 Avenue, Surrey, BC. Here is a what3words link and map: https://what3words.com/markers.addiction.ozone

Weekly SARC Social

Saturday between 0730 and 0930 hrs at the Denny's Restaurant, 6850 King George Blvd., Surrey BC

Workshops

Saturday between 1000 and Noon at the OTC 5756 142 Street, Surrey

SEPAR Net

Tuesday at 1930 hrs local on 147.360 MHz (+) Tone=110.9

SARC Net

Tuesday at 2000 hrs local on 147.360 MHz (+) Tone=110.9

VE7RSC Repeaters

2m North: 147.360MHz+ Tone=110.9Hz
IRLP node 1736
Echolink node 496228

2m South: 147.360MHz+ Tone=103.5Hz Fusion capable; No IRLP/EchoLink

1.2m: 223.960 Mhz -1.6 Tone=110.9Hz

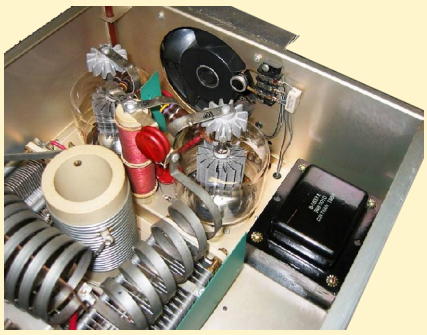
70cm: 443.775MHz+ Tone= 110.9Hz
IRLP node 1737
WiRES-X Room ID 00047

We Have A SARC Patch!

These are suitable for sewing on a jacket, cap or your jammies, so you can proudly display your support for the club.

The price is $4 each or three for $10 and they can be picked up at a meeting or the weekly Koffee

Thank You iCOM Canada for your generous support of our VE7RCAF and Field Day 2024 efforts



Guy VA7GI has two items of note:

- *Guy's article "Reinventing Spark Gap Radio" will be published by TCA Magazine. Both spark transmitter and coherer receiver work.*
- *He has a fully reconditioned Drake L7 amp for sale (including QSK with vacuum TR relay) as shown above.*

Need more information? Contact: Guy Immega VA7GI Vancouver, BC
Phone: 604-222-8700 ◦ Cell: 604-250-6599 ◦ www.guyimmega.com ◦ email: guy.immega@kinetic.ca